American Machinist

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EXPOSITION NUMBER

National Machine Tool Builders' Exposition

AND

National Machine Tool Congress

CLEVELAND

September 30 to October 4, 1929

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THIS number of the *American Machinist* is devoted to the National Machine Tool Builders' Exposition which will be held at Cleveland from September 30 to October 4, inclusive, and to the National Machine Tool Congress which is to be held concurrently.

In the following pages there will be found a full list of the exhibitors and their exhibits, together with booth numbers, the names of attendants and a floor plan of the exposition. Another section contains descriptions and photographs of new equipment which will be on display at the show. An editorial analysis of the new equipment described shows the advances that have been made in the past year.

The National Machine Tool Congress program:

MONDAY. "What Information Does the Machine-Tool Buyer Need from the Machine-Tool Salesman," a paper and discussion by G. T. Trundle, Jr., president of the Trundle Engineering Co., Cleveland. P. E. Bliss, president of the Warner & Swasey Co., will preside.

TUESDAY. "Present Status of Cemented Tungsten-Carbide Tools and Dies," a paper by Dr. Zay Jeffries, of the General Electric Co. Ralph E. Flanders, manager of the Jones & Lamson Machine Co., Springfield, Vt., will preside.

WEDNESDAY. "Economic Production Quantities," a paper by Prof. F. E. Raymond, of the Massachusetts Institute of Technology, secretary of the Management Research Committee of the A.S.M.E.

THURSDAY. Round table discussion of the subjects: "The Application of Standard Machine Tools to Automobile Manufacture," "Results in Production Due to New Features of Machine-Tool Construction," "Synchronized Automobile Parts at the Assembling Line," and "The Basis of Replacing Machine Equipment."

SESSIONS will be held in the ballroom of the Hotel Cleveland starting at 8 p.m. On Friday evening there will be a dinner in the ballroom at 6:30 p.m. The first two sessions are sponsored by the Machine Shop Practice Division of the A.S.M.E., while the Wednesday and Thursday sessions are sponsored by the Production Division of the Society of Automotive Engineers.

Exhibitors · Products · Representatives

National Machine Tool Builders' Exposition

[Booth Numbers Follow Company Names]

—A—

Abrasive Machine Tool Co. 2W 5. No. 3 surface grinder, 22 in. x 8 in. x 12 in.; No. 33 surface grinder, vertical spindle, 22 in. x 7 in. x 12 in.; No. 5 surface grinder, 48 in. x 14 in. x 14 in.; dust exhaust attachment; wet grinding attachment; magnetic chucks; self-contained D. C. generator; dial test indicator; 8 in. index centers; 8 in. semi-direct index centers.

F. N. MacLeod, N. D. MacLeod, C. G. MacLeod, K. B. MacLeod, W. Sceeles, E. S. Cornell.

The Acme Machinery Co. 2D 5. Acme all-steel bolt heading, upsetting and forging machine; bolt threading machine, cutting standard style of thread; semi-automatic nut threading machine; nutting-up machine.

H. N. Anderson, sales mgr.; R. D. Davies, secretary and treasurer; K. F. Bruch, vice-president.

The Acme Machine Tool Co. 2B 14. 17 and 4½ in. Cincinnati Acme full Universal hex. turret lathe; No. 1 Cincinnati Acme semi-Universal hex. turret lathe.

Charles Meier, Fred Winkelman, W. Behrens, H. V. Myers, Lee G. Leon.

Ahlberg Bearing Company. 4W 10. "CJB" Master ball bearings; Ahlberg ground bearings.

C. J. Bender, president; G. L. McGregor, asst. sales mgr.; B. B. Clark and R. H. Kelly, district sales managers; B. S. Okner, chief engineer.

Chas. G. Allen Co. 1W 11. Sensitive ball bearing drilling and tapping machines.

Chas. G. Allen, Chas. G. Allen, Jr.; John S. Wecks.

Allis-Chalmers Mfg. Co. 5C 11. "Texrope" speed reduction unit in operation; totally inclosed fan cooled motor; squirrel case induction motor; direct-current machine tool motor.

A. H. Wyman, district mgr.; V. E. Walters, W. F. Sheriff, M. V. Bailliere; F. A. Miller, salesman Cleveland district office; L. E. Grothaus, asst. mgr. electrical dept., Milwaukee; J. C. Rattermann, asst. mgr. electrical dept., Norwood, Ohio; Walter Geist, asst. mgr. milling dept., Milwaukee.

American Broach & Machine Co. 1W 22. Hydraulic, vertical and horizontal broaching machines; broaching tools; hydraulic presses.

Francis J. Lapointe, president; David A. DeLong, secretary; J. A. Livingstone, sales rep.; William Pfeil, tool designer; J. E. Jones, engineer.

American Machinist. 1E 2. American Machinist—a weekly publication.

Mason Britton, James A. McGraw, F. S. Weatherby, W. S. McFaddin, Ray Deen, W. E. Irish, J. M. Wells, W. E. Kennedy, Dwight Cook, W. H. Shipman, F. H. Colvin, K. H. Condit, Geo. E. Hagemann, H. R. LeGrand and F. J. Oliver, Jr., editors; H. G. Stephanson, div. sales mgr. circulation; O. W. Larkins, circulation sales; A. W. Morrison, mgr. field circulation.

The American Tool Works Co. 2D 3. Lathes; radial drills; shapers—all motor driven.

J. B. Doan, president and general mgr.; A. E. Robinson, works mgr.; R. S. Alter, vice-president and foreign mgr.; L. W. Scott Alter, asst. to president; J. C. Hussey, sales mgr.; H. W. Schatz, eastern sales mgr.; D. M. Bartlett, C. H. Cormany.

Armstrong-Blum Mfg. Co. 4A 5. "Marvel" metal band sawing machine; "Marvel" automatic high speed saw; "Marvel" hack sawing machines; "Marvel" high speed edge hack saw blades.

Harry J. Blum, George J. Blum, Fred J. Blum, Stanley A. Woleben, H. Conrad, Walter S. Ryan, J. E. Van Doren.

Armstrong Bros. Tool Co. 4C 2. Lathe, planer and shaper tools; lathe dogs; clamps; ratchet drills; drop forged wrenches; pipe vises; pipe cutters; stocks and dies; pipe wrenches; machine shop specialties.

Horace Armstrong, A. Arbogast, S. W. Welter, George Nufer.

Arter Grinding Machine Co. 1W 8. 12 in. rotary surface grinder with magnetic chuck, wet grinding equipment, including pump and tank, arranged for motor drive complete with motor; No. 132 automatic cylindrical grinder with wet grinding equipment including pump and tank, with complete tooling for grinding valve stem guides.

William Arter, president; Warren F. Fraser, works mgr.; Albert B. O'Donnell, sales mgr.

Associated Machine Tool Dealers 2W 0.

E. C. Atkins & Company. 5C 6. No. 18 Kwik-Kut power hacksaw; No. 7 Kwik-Kut power hacksaw; No. 4 metal cutting bandsaw; Silver-Steel hacksaw blades; Atkins hacksaw frames.

E. C. Atkins, production mgr.; W. A. Atkins, works mgr.; Edward S. Norvell, mgr. metal saw dept.; W. R. Chapin, metallurgist; M. M. Poole, purchasing agent; D. M. Condit and A. Mertz, salesmen.

Automatic Nut-Thread Corp. 3W 2. No. 2 and No. 3 Threadnut full automatic nut tapping machines; No. 1 single spindle tapping machine, full automatic; No. 1 hand tapping machine, single spindle; No. 7 single spindle semi-automatic.

Eric M. deSherbinin, president; Christian S. Sorenson, gen. mgr.; Robert B. Webster, secretary-treasurer; Edward H. Ingram, engineer; LeRoy J. Mickle, superintendent.

Automotive Industries. 4W 7. Automotive Industries—a weekly publication; Automotive Industrial Red Book; Chilton Aero Directory and Catalog.

J. S. Hildreth, director of sales; Julian Chase, business mgr. Auto Ind.; T. L. Kane, business mgr. direc. dept. and W. A. Kirkpatrick, asst.; N. G. Shidle, directing editor; A. F. Denham, field editor; E. B. Neil, research engineer; J. C. Hildreth and A. E. Meanor, Cleveland representatives.

The Avey Drilling Machine Co. 1A 6. High speed sensitive drilling and tapping equipment; drilling units; metal cutting saws; compensating jaw vises.

L. B. Patterson, president; J. G. Hey, vice-president and gen. mgr.; D. A. Patterson, secretary; J. F. Mirrielees, superintendent; F. L. Hazledine and G. M. Galt, factory representatives.

—B—

Baker Brothers, Inc. 2B 13. No. 121 Baker heavy duty vertical drilling machine with Tex-Rope motor drive; No. 25 H Baker vertical hydraulic feed five spindle six station indexing table drilling and boring machine; No. 25 HH Baker two-way hydraulic feed drilling and boring machine; No. 10 H Baker vertical hydraulic feed drilling machine with adaptation for multiple heads; individual motor-driven outfit for pumping various coolants.

H. L. Tigges, W. W. Elliott, William Baker, G. E. Hallenbeck, M. Fischer, G. Temple.

The Baker-Raulang Company. 4W 6. Model E3 three-ton elevating truck equipped with one-ton swivel hoist; Model H3 three-ton Hy-lift truck.

Glen E. Guy, C. H. Reinde, B. C. Hooper, C. H. Warren.

Barber-Colman Company. 1C 2. Type B production hobbing machine—a new high production gear generator; No. 3 hob sharpening machine—an automatic mechanically controlled hob and form cutter grinder; reamer sharpener—an automatic machine for highly accurate work under positive mechanical control; small tools; hobs, milling cutters, reamers.

F. G. Hoffman, G. A. DeVlieg, A. B. Brand, J. P. Breuer, R. P. Dewey, M. N. Hough, C. G. Seyfferle, W. W. Dickover, J. E. Wood, F. R. Ridgley, W. M. Roey.

Barnes Drill Co. 2D 4. No. 214 multiple cylinder honing machine with hydraulically reciprocated spindles, all geared, self-oiling, all ball bearing; No. 249 self-oiling all geared honing machine with Timken roller bearings and eight quick changes of speeds; No. 242 self-oiling all geared drill and topper with Timken roller bearings; two spindle No. 242 self-oiling all geared gang drill with Timken roller bearings; No. 221½ self-oiling all geared drill and tap-

per; No. 262 self-oiling all geared drill and tapper.

J. E. Andress, president; A. G. Block, secretary; A. M. Johnson, chief engineer; W. M. Fairbairn, production manager; R. M. Andres, purchasing agent; W. G. Nichol and M. C. Hogard, sales dept.; F. A. Swanson, designing engineer.

W. F. & John Barnes Co. 2B 9. W. F. & John Barnes Co. horizontal Duplex long hole drilling machine; vertical motor driven Oilgear feed drilling machine; vertical motor driven Oilgear feed reaming machine with automatic indexing fixture.

John S. Barnes, V. A. Root, Ralph Billingham, Paul Guirl, William J. Mix, F. G. Vosler.

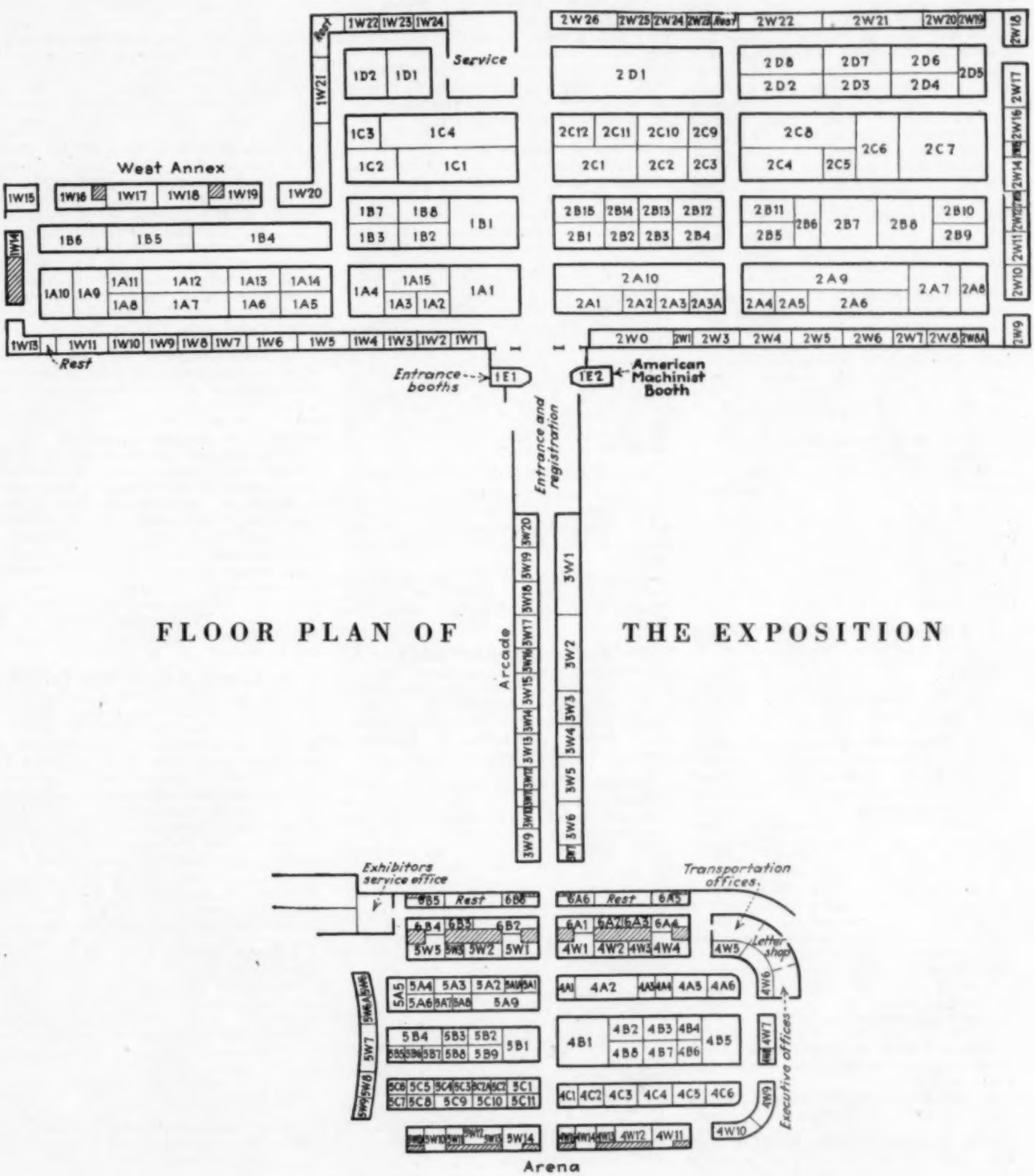
The Leon J. Barrett Co. 1W 13. Barrett centrifugal oil extractor, model 1200; centrifugal dryer, model 502; centrifugal washer, model 251; Stockbridge heavy duty back-geared shaper with patented two-piece crank.

Leon J. Barrett, R. A. Johnson, H. G. Kilbourne, C. B. Laing, and N. F. Holter.

John Bath & Co., Inc. 5W 1. Ground taps; thread gages; ground thread rolling dies; Bath internal micrometers; adjustable plain plug gages.

John Bath, president; J. Chester Bath, vice-president; Stanley W. Bath, secretary; R. F. Lamb, advtg. manager.

Bausch & Lomb Optical Co. 6A 5. Metallographic microscope; contour measuring projector; optical comparitor; toolmakers' microscope; optical drill



gauge; internal and external profile gauge; optical protractor; optical indexing device; (all precision optical instruments for production control.)

I. L. Nixon, mgr. projection sales; E. G. Koch, projection sales dept.; George Gallasch, technical bureau; A. Farmer, salesman.

Charles H. Besly & Company. 2D 6. No. 6 20-in. double spindle motor driven wet disk grinder with power driven oscillating fixture, four station indexing drum equipped with cam clamping vee blocks for grinding exhaust and inlet valves on both ends simultaneously; No. 309 30-in. vertical spindle motor driven wet disk grinder with power driven rotary and semi-automatic feeding fixture for grinding face of Universal joint housings; No. 141-20 in.-L type motor-driven disk grinder with Timken bearing rocker-shaft supports; No. 5-18 in.-F type motor-driven disk grinder; Besly Titan bakelite abrasive disks and steelbac abrasive disks.

Edward P. Welles, L. R. Capes, L. E. Jacobs, C. H. Munch, F. D. Baker, E. W. Hutchinson, J. F. Curns, George Klemp, R. J. Curns, R. W. Young, John Miller, Jr., John Neilson, Frank Lane, E. O. Powers, Clarence Stephenson, Albert J. Doerman.

Biax Flexible Shaft Co., Inc. 5A 6. Screw driving machine; drilling machines; portable flexible shaft grinders; rotary filing machines; rotary files; high speed grinders for die work; portable sanding and polishing machines; portable track grinders.

R. Wezel, F. I. VanderBeek.

The Black & Decker Mfg. Co. 4B 1. Universal portable electric tools; high cycle portable electric tools; Marschke grinders and Marschke swing frame grinders.

W. C. Allen, R. D. Black, R. E. Mizener, G. M. Buchanan, A. M. York, Lee H. Hind, Gus Fischer, Ralph Herrick, J. A. Fairfield, Luke Boyd, W. J. Fenwick, W. T. Johston, Guy J. Coffey, C. C. Watts, W. S. Talbott.

G. S. Blakeslee & Co. 4C 3. Blakeslee pump type parts washing machine; Niagara type parts washing machine.

John Dammers, secretary; H. A. Sparrow, G. W. Anderson and A. S. Reichel, sales engineers.

The Blanchard Machine Company. 1W 5. Blanchard automatic surface grinder No. 16-A; 18 in. segment wheel; silicate wheels and segments; samples of Blanchard grinding.

Harold F. Skillings, Harold C. Donovan, Leon S. Kinsman, William H. Cannon.

J. G. Blount Co. 1W 2. Motor grinders—regular and high speed—tool or snagging; combination motor grinder and disk sander for pattern shops; wet tool grinders; motor buffers; pattern maker's lathe—eight speed, motor drive.

H. N. Blount, sales mgr.; J. G. Blount, production mgr.; F. G. Koppenburg, factory superintendent.

Bowen Products Corporation. 5A 7. Bowen system of lubrication for industrial machinery.

George W. Severson, Willis S. Meeks, Fred Whipple, E. Heilbron.

The Boye & Emmes Machine Tool Co. 3W 7. 16 in. x 6 ft. coneless geared head lathe; 16 in. head size only.

F. W. Boye, Jr., F. C. Reif, George A. Mohr, shop superintendent.

The Bradford Machine Tool Co. 2A 4. 18 in. Bradford all geared patented lo-drive motor-driven engine lathe, with taper turning attachment and oil pan; single spindle automatic unit type Bradford drilling machine for high-speed automatic production.

Samuel S. Williams, president; Charles J. Smith, secretary; Henry Swift, engineer; Charles Stiefvater, demonstrater; Fred Kropf, superintendent.

Bridgeport Safety Emery Wheel Co., Inc. 1A 5. 86 in. Type No. 94 heavy-duty face grinder, 4 in. sectional grinding wheel, hydraulic table drive; 20 in. steel chuck and sectional grinding wheel.

H. H. Peck, secretary; L. I. Burritt, sales mgr.; F. C. Penny, chief engineer; H. E. Smith, sales engineer.

Brown & Sharpe Mfg. Co. 2C 8. No. 2A standard universal milling machine; No. 4B Standard plain milling machine; No. 2 standard vertical spindle milling machine; No. OY plain milling machine; No. 21 automatic milling machine; No. 2 universal grinding machine; No. 13 universal and tool grinding machine; Nos. 11, 30 and 32 plain grinding machines; No. 2 surface grinding machine; No. OOG automatic screw machine (high speed); No. 2 automatic screw machine (high speed); machinists' tools, cutters and hobs.

J. G. Swinburne, L. Goff, R. W. Blakey, H. R. Johnson, R. Martines, E. S. Thurston, S. H. Sloan, J. H. Devlin, F. L. Pritchard, P. A. Topel, E. H. Anthony.

Bryant Chucking Grinder Co. 2B 12. No. 24 deep hole grinder with hydraulic slide traverse and automatic sizing; No. 12-A hole-face grinder; No. 3 heavy-duty hole grinder; No. 3 standard hole grinder.

L. C. Gilchrist, W. L. Bryant, M. H. Arms, J. B. Johnson, R. O. Perry, W. M. Smith, G. M. Green, H. G. Nourse, A. G. Fairbanks.

The Buckeye Portable Tool Co. 4 A1. Portable pneumatic grinders, buffers, drills, sanders, screw-drivers, nut drivers.

W. W. Price, president; H. O. Gummere, special rep.; C. W. Overly, Cleveland district mgr.; W. R. Gummere, special representative.

Buffalo Forge Company. 1A 4. Power drills; power bending rolls; combination punches and shears, fans and exhausters, all in operation.

H. W. Wendt, Jr., vice-president; E. G. Leonard, sales mgr. Tool div.; G. H. Zimmer, design engineer, T. A. Weager, mrg. Cleveland office; A. T. Yates, service engineer; H. H. Weber, J. E. Mossell, R. L. Pope, W. J. McDowell and A. T. Lamb, sales representatives.

Buhr Machine Tool Co. 2D 7. Buhr multi-head automatic drilling machines and automatic index tables; Buhr automatic piston drillers; Buhr drilling and tapping heads; Buhr Universal adapters and drivers for drill presses.

Joseph F. Buhr, president; C. A. Birkebak, chief engineer; Glenn D. Evans, sales mgr.; Robert S. Gott, works mgr.; William H. Nicholls and Raymond Zoll, sales engineers.

The Bullard Company. 1B 1. 8 in. Mult-Au-Matic center lathe; 6 in. four-spindle Mult-Au-Matic chucking lathe with hopper feed; 20 in. Auto-Matic vertical turret lathe; 36 in. "Spiral Drive" type vertical turret lathe.

E. P. Bullard, president; John W. Bray, sales mgr.; E. P. Blanchard, asst. sales mgr.; John R. Tillman, executive sales engineer; Charles H. Keller, F. S. Lincoln, Frank E. Hatch, Jr., James M. Welch, George F. Kolb, F. A. Thompson, Robert Newman, William A. Conner, sales representatives.

—C—

Canadian Machinery & Manufacturing News. 5C 7. Canadian Machinery—a bi-weekly publication.

B. G. Newton, manager; J. H. Moore, adv. manager; R. A. Aymong, western representative; Herb C. Braund, editor.

Canedy-Otto Mfg. Co. 5C 10. Multiple spindle floor drill, motor driven; high-speed motor driven drill press; 21 in., 17 in., 14 in., 15 in. sliding head motor-driven drill presses (all floor drills).

C. H. Thomas, president; J. E. Thomas, secretary and treasurer; C. L. Hughes, sales mgr.; R. D. Thomas, San Francisco branch mgr.; W. F. Wendel, New York branch mgr.; L. H. Howard, salesman; G. F. Werth, chief engineer; F. L. Cole, factory mgr.

Carboloy Company, Inc. 4A 2. Carboloy cutting tools for high production machining of ferrous, non-ferrous and abrasive metals and materials; dies for wire drawing and extrusion work for routine high tonnage production.

P. R. Mallory, president; E. H. Wilkinson, vice-president; A. R. Howell, sales mgr.; G. V. Rockey, advtg. mgr.; G. N. Sieger, metallurgist; A. A. Merry, mgr. Cleveland district; W. G. Robbins, Mgr. Detroit district; W. W. Fullager, mgr. Chicago district; W. J. Lindner, mgr. eastern district; P. Petroff, federal and marine div.; W. H. Martin, wire die div.; W. S. Huson, New York office; W. G. Lane, Pacific coast district; W. E. Smith, service mgr.; S. C. Lawson, chief engineer.

The Carlton Machine Tool Co. 2B 2. 3 ft. 11 in. column Carlton all ball bearing, heavy duty radial drilling machine arranged for constant speed motor drive on arm, with plain box table and cutting lubricant outfit; 6 ft. 19 in. column Carlton all ball bearing heavy duty radial drilling machine arranged for adjustable speed motor drive on arm, with plain box table, electric hydraulic column binder, motor driven cutting lubricant outfit, power rapid traverse of head.

Jack C. Carlton, Harry J. Westmeyer, Herbert D. Keeling and Frank Moran, sales representatives; W. A. Dermody, Albert C. Spangenberg, A. F. Medecke.

Chicago Belting Co. 5W 7. Motor drive belts; flexible idler belts; line and countershaft belts; charts on belt ratings and belt properties; leather belting; hydraulic and pneumatic leathers; leather packings; leather tannages; motion picture illustration of how leather belt is made.

J. R. Hopkins, Floyd Hance, Charles Allis Ball, A. J. Weis.

The Chisholm-Moore Hoist Corp. 6B 6. Electric hoists and trolleys; chain hoists and trolleys.

F. W. Shaw, asst. sales mgr.; J. G. Parker, plant engineer; E. N. Turner, sales engineer.

The Cincinnati Bickford Tool Co. 2A 1. Radial and upright drills including 6 ft. "Super-Service" radial with 19 in. column; 3 ft. "Super-Service" radial with 11 in. column; 21 in. direct drive upright; "Super-Service" production drill.

A. H. Tuechter, president; G. P. Gradolf, D. C. Klausmeyer, N. C. Shaver, O. E. Shaver, S. K. Wallace, L. D. Quackenbush, R. N. Piper.

Cincinnati Grinders, Inc. 2C 7. Plain hydromatic miller; Duplex hydromatic miller; No. 3 Universal miller; No. 3 plain miller; Cincinnati cutter grinder; Cincinnati No. 2 centerless valve tappet grinder; No. 2 centerless piston pin grinder; No. 4 centerless bearing race grinder; 14x48 plain cylindrical grinder.

F. A. Geier, F. V. Geier, P. O. Geier, W. W. Tangeman, F. B. Heitkamp, R. E. W. Harrison, G. W. Binns, J. E. Caster, L. Nenninger, Hans Ernst, M. R. Romaine, E. G. Roehm, R. L. Morrissey, Nelson Caldwell, S. E. Bergstrom, E. Reiniger, S. R. Howells, R. E. Fields, Howard Pope, W. F. Stegner, Carl Mueller.

The Cincinnati Lathe & Tool Company. 2W 18. 16 in. x 6 ft. Cincinnati geared head lathe for tool room work; 24 in. x 10 ft. geared head lathe, motor drive, with square turret attachment for severe duty work.

W. C. Heindel, W. J. Anderson, E. C. Cummings, K. I. Clisby, A. C. Meier, George Doll, Wm. Fisgus.

The Cincinnati Milling Machine Co. 2C 7. Plain hydromatic miller; Duplex hydromatic miller; No. 3 Universal miller; No. 3 plain miller; Cincinnati cutter grinder; Cincinnati No. 2 centerless valve tappet grinder; No. 2 centerless piston pin grinder; No. 4 centerless bearing race grinder; 14 x 48 plain cylindrical grinder.

F. A. Geier, F. V. Geier, P. O. Geier, W. W. Tangeman, F. B. Heitkamp, R. E. W. Harrison, G. W. Binns, J. E. Caster, L. Nenninger, Hans Ernst, M. R. Romaine, E. G. Roehm, R. L. Morrissey, Nelson Caldwell, S. E. Bergstrom, E. Reiniger, S. R. Howells, R. E. Fields, Howard Pope, W. F. Stegner, Carl Mueller.

The Cincinnati Shaper Co. 2W 17. 16 in. heavy duty Cincinnati rapid traverse shaper equipped with Universal table; 24 in. heavy duty Cincinnati rapid traverse shaper; Cincinnati gear burnisher; shaper parts and various assemblies.

H. S. Robinson, R. T. Hazleton, T. H. Schebrat, M. A. Spraley, George Diehl, Frank T. Goetz, F. G. Swain.

The Cleveland Automatic Machine Co. 2C 5. Model M ½-in. five spindle bar machine with independent feed control for all tools; ¾ in. model M four spindle multiple drilling, forming and cut-off machine, blanking four nuts simultaneously from the bar; 7 in. model M five spindle chucking machine for castings, forgings or stampings.

A. L. Garford, president; H. W. Rupples, gen. mgr.; H. M. Rich, secretary-treasurer; C. W. Cowdrey, sales dept.; Herbert E. Nunn, B. C. Young, A. W. Schafer, W. Steinbrenner, G. W. Samstag, Arthur Jackson.

Cleveland Hobbing Machine Co. 1A 10a. Eight spindle rotary hobbing machine.

C. W. Blossom, president; W. H. Staples, vice-president and gen. mgr.; F. H. Adams, vice-president.

The Cleveland Planer Company. 1C 3. Cleveland open side planers.

E. L. Essley, president; E. P. Essley, secretary; L. H. Mesker, sales mgr.; J. Jenne, works manager.

The Cleveland Twist Drill Company. 4W 11. Drills; reamers.

W. E. Caldwell, H. P. Jenson, J. B. Dillard, T. M. Skove, D. D. Burdett, H. J. Baier, R. G. Berrington, H. G. Smith, F. M. Hoelzle, A. J. Ireland, O. B. Hansen, R. D. Boltey.

Cochrane-Bly Company. 2C 12. No. 66 metal sawing machine with hydraulic feed and air clamp; No. 55 metal sawing machine with air clamp and multiple cutting fixtures; No. 21 automatic high speed saw with power stock feed; No. 2 filing machine; No. 11 saw sharpening machine, and the No. 14 Duplex shaper-miller.

W. H. Welch, vice-president; T. M. Crandall, secretary-treasurer; Bracket Clark.

Colonial Tool Company. 5A 4. Michigan Tool Company milling cutters, hobs, gear-shaper cutters, special tools; Colonial Tool Company round, spline, and combination round-and-spline broaches; spline gauges.

Otto Lundell, president and gen. mgr., Michigan Tool Co.; O. L. Bard, secretary, Michigan Tool Co.; J. W. Mull, Jr., sales manager, Michigan Tool Co.; C. J. Halborg, general manager, Colonial Tool Co.; E. H. Kurtz, sales manager, Colonial Tool Company.

The Columbia Machine Tool Co. 2W 15. Columbia 24 in. superior heavy duty back geared crank shaper with speed box, friction clutch and brake and constant speed motor drive; vertical chucking machine of complete new design.

F. B. Yingling, E. S. Rich, F. Fiesselmann, O. G. Tweddell.

Conradson Tool Corp. 4A 3. Shell reamers; expansion reamers; arbors; milling cutters.

W. J. Denning, executive; Stephen Carboy and F. J. McHugh, sales department.

Consolidated Machine Tool Corp. of America. 2C 4. Heavy duty boring mill; cold saw; milling machine; small tools for threading.

A. H. Ingle, Alfred Trosch, W. C. Ingle, H. M. Bowman, R. R. Roberts, W. J. Forward, H. A. Merrill, R. S. Laird, A. Myers, L. T. Jefferis, C. E. McArthur, C. R. Williams, S. A. Harding, P. I. Johnston, G. C. Bailey.

Covel-Hanchett Co. 2A 9. Two-spindle horizontal grinding machine; face grinding machine, 20 in. wheel; large size double-spindle machine with special fixtures; combination face grinding and locomotive guide bar grinder; vertical spindle machine; automatic surface grinder; Universal cutter and tool grinder; small size surface grinder; twist drill grinders; small size metal saw sharpening machine; large size metal saw sharpening machine.

E. B. Gardner, A. M. Johnson, W. S. Paden, Ed. Ellefson, L. H. Benjamin.

The Cushman Chuck Co. 5B 2. Collet chucks; dust-proof chucks; new pattern lathe chucks; boring mill jaws.

Harry E. Sloan, president; Harry W. Hultgren, sales dept.; James Jordan, superintendent; George Highberg, asst. superintendent.

Cutler-Hammer, Inc. 6A 1. A.C. and D.C. automatic motor control; planer control; A.C. and D.C. manual motor control; across-the-line "X" automatic starters; safety switches; push buttons; accessories.

A. G. Pierce, Cleveland district mgr.; F. U. Webster, advtg. manager.

—D—

Danly Machine Specialties, Inc. 4B 6. Die makers' supplies; die sets; guide posts; guide bushings; dowel pins; automatic gages; die springs; shoulder screws; socket head cap and set screws.

R. C. Danly, president; R. H. Danly, vice-president and gen. mgr.; J. R. Fitzsimons, mgr. Cleveland branch; A. L. Miller, mgr. Long Island City branch; George T. Danly, chief engineer; W. L. Rankin, mgr. Detroit branch; A. F. Wallace, mgr. Rochester branch.

DeVlieg Machine Tool Company. 2A 2. High-powered precision simplified production type milling machine.

Chas. B. DeVlieg, president and gen. mgr.; N. S. Lundberg, chief engineer.

DeWalt Products Corporation. 6B 5. DeWalt Wonder Metal Worker for cutting steel tubing; DeWalt Wonder Worker, a combination woodworker; DeWalt jointer; DeWalt mortiser.

Paul Gardner, president; L. J. McLaughlin, district sales mgr.; Robert H. Mulch, gen. sales mgr.; Walter Knapp, engineer.

Diamond Machine Co. 2A 8. Diamond face grinding machine; Type H surface grinding machine, Universal head; continuous grinding machine.

D. K. Bartlett, A. A. Wood, L. L. Lorey, Morris Slepkow, G. W. Clausson.

Henry Disston & Sons, Inc. 4B 8. Metal cutting saws, files and tool steel; a fast running cut-off machine in operation; band saw machine in operation; hack saw machine in operation.

S. Horace Disston, vice-president; George Satterthwaite, vice-president; H. A. Baxter, gen. sales mgr. for steel and metal cutting saws; J. C. Forrest, sales mgr. for metal saws; Charles Thompson, experimental engineer; H. Allen, chief metallurgist; Normal Bye, chief engineer.

The Dreses Machine Tool Co. 2W 12. Three ft. 11 in. column "Multi-duty" radial drill.

C. E. Gilbert, J. Wiebell, superintendent; J. Disser, chief engineer; A. Schlachta, demonstrator.

—E—

The Eastern Machine Screw Corp. 1W 3. "H & G" self-opening die heads; high speed hob chasers; "H & G" threading machine, chaser grinder and feed pushers.

C. W. Bettcher, sales mgr. and secretary; O. H. Hoelzel, A. E. Chadwick, H. F. Wieler, B. DePolo, G. E. Mager, J. E. Jennings, F. J. O'Rourke, A. Jack-

son, J. C. Fletcher, Victor Larson, H. Dobson.

Eclipse Interchangeable Counterbore Co. 5B 4. Counterbores; countersinks; core drills; multi diameter cutters and special production tools for automotive and airplane motor manufacturers; operating demonstration of production tools.

R. G. Michell, gen. mgr.; A. C. Warn, asst. gen. mgr.; J. H. Smith, sales mgr.; U. G. Thomas, factory superintendent; L. N. Hall, Cleveland district mgr.; O. W. Dawson, G. Sealander and C. M. Bigger, sales representatives.

The Economy Engineering Co. 1W 15. ¾ in. Economy automatic shaving machine, type S; ¾ in. combined automatic pointing and threading machine; ¾ in. four-spindle semi-automatic threading machine.

F. O. Andrews, president; F. S. Andrews, asst. president; Louis Steinfurth, chief engineer.

Elwell-Parker Electric Co. 6B 1 and 2. Electric industrial trucks; electric tiering trucks; new "Swiss Model" electric lift trucks; portable electric cranes.

J. P. Lyons, C. B. Cook, R. F. Crawford.

Ex-Cell-O Aircraft & Tool Corp. 5A 9. Tool steel drill jig bushings; internal grinding spindles; Diesel fuel pump parts; tool detail parts; Aircraft engine precision parts.

N. A. Woodworth, president and gen. mgr.; W. F. Wise, sales mgr.; J. E. Wells; J. F. Hanlon, special rep.; H. E. Henry, Cleveland representative.

—F—

Fafnir Bearing Co. 5W 10. Line of ball bearings.

E. R. Carter, H. R. Reynolds, E. B. Hand, W. L. Rager.

Fairbanks, Morse & Co. 5C 9. Sectionalized 25 hp. squirrel-cage motor; sectionalized clean-air-jacket motor; clean-air-jacketed ball-bearing motor in operation; direct-current ball-bearing motor, a range of various sizes of ball-bearing motors.

K. W. Jones, J. R. Kindig, H. C. White, J. R. Patterson, Glen H. Corlette, G. J. Podlesak, C. E. McLaughlin, F. M. Gardner, R. L. Johnson.

Farrell-Birmingham Co., Inc. 3W 5. No. 2-A Sykes gear generator; No. 1-A Sykes gear generator; one-tooth pinion stand; gear box of selective type with 40° angle Sykes herringbone gears constantly in mesh; range of Sykes gear tooth comparators.

A. G. Kessler, W. E. Sykes, Austin Kuhns, T. Holloway, H. E. Kitchen, J. Leahy, Paul Manager, John Brandt.

The Fellows Gear Shaper Company. 2B 8. Machines for cutting gears for four-speed transmission gear boxes, including No. 712 high-speed gear shapers for roughing and No. 77 side trimming high-speed gear shaper for finishing; No. 7A drop apron high-speed gear shaper; No. 7A standard high-speed gear shaper for cutting steel gear blanks having a 2 in. face; No. 75 high-speed gear shaper for cutting helical gears; a high-speed gear shaper with a kickoff and reversing attachment for cutting segment gears for a cash register; No. 612A gear shaper for cutting steel gear blanks of 5 in. face width; a thread generator in operation "Red Liner" automatic gear inspection machines; an involute testing machine for inspecting gear shaper cutters.

E. R. Fellows, president and gen. mgr.; E. J. Fullam, secretary and treasurer; R. M. Fellows, P. A.; W. F. Slomer, gen. sales mgr.; E. W. Miller, chief engineer; E. Stubbs, factory mgr.; C. C. Bankes, J. B. Strong, C. J. Nagel, F. P. McGrath; Douglas T. Hamilton, advtg. manager.

The Flather Company. 1W 4. 20 in. x 10 ft. motor driven geared head engine lathe.

H. L. Flather, president and treasurer; J. H. Flather, vice-president; H. H. Flather, asst. treasurer; J. H. Connor, superintendent.

Foley Manufacturing Company, Inc. 6B 3. Foley automatic saw filers; automatic hack saw grinders; circular saw grinders; hand saw re-toothers; automatic saw setting equipment.

W. M. Ringer, president; W. F. Rehbock, sales mgr.; C. H. Carlson, director of production; F. E. Collier, superintendent; G. O. Steen, service mgr.; W. P. Tobey, Jr., New England sales representative.

The Foote-Burt Company. 1A 12. No. 1 surface broaching machine; No. 15½-F six-spindle drilling machine; No. 16 hydraulic feed drilling machine; No. 15½-D drilling machine; No. 22½ high duty drilling machine; BW-23 two-spindle sensitive drilling machine; No. 1½ two-spindle sensitive drilling machine; DE-1 single-spindle sensitive drilling machine; No. 4½ independent feed drilling machine.

G. E. Randles, president; T. H. Doan, Jr., vice-president; R. E. Delamater, Ira D. Grove; W. F. Babcock, Detroit rep.; David F. Noble, Chicago rep.; Herbert Kennedy, eastern representative.

The Fosdick Machine Tool Company. 1A 3. No. 2 two spindle sensitive drill, 13 in.; No. 4 two spindle sensitive drill, 24 in.; No. 5 three spindle sensitive drill, 16 in.; 6 ft. 19 in. column "Economax" radial drill.

N. B. Chace, William C. DeRoo, A. Kuehn.

Foster Machine Company. 2C 2. No. 5 all geared head Universal turret lathe; 1-F turret type "Fastermatic"; 3-F platen type "Fastermatic"; 3-F turret type "Fastermatic"; 4-F platen type "Fastermatic."

W. H. Foster, president; H. A. Moore, gen. sales mgr.; Carl Moser, Jr., sales engineer; Harry Lyon, sales engineer; O. B. Clemens, demonstrator.

Fredericksen Company. 5W 6. Spindle bearings; lead screw nuts; miscellaneous machine tool bearings and bushings of Sabeco bearing metal; worm gear castings.

Arthur A. Schupp, gen. mgr.; Henry C. Limbach, sales mgr.; C. D. Proctor, New York rep.; Ralph H. Sherry, Chicago rep.; Karl A. Agricola, factory rep.; William L. Agricola, general superintendent.

The Frew Machine Co. 3W 16. No. 1 automatic tapper; No. 4 hand milling machine; No. O Duplex drill; No. 2 automatic tapper.

George H. Frew, H. Edwards.

—G—

The Gairing Tool Co. 4B 2. Small tools; swing tool boring and facing heads; full floating holders; quick-change floating tap holders; multiple boring and facing cutters; multiple operation core drilling, counterboring and chamfering tools, inserted blade and solid type; Gairing nose drive reamers; inserted blade and solid; inserted blade hollow mills; inverted counterbores; standard counterbore sets for tool room machine shop use; chucking reamers; off-set spot facing heads; grinding fixtures. Standard type A, B and C counterbores and core drills, multiple operation cutters, Gairing full floating holders and nose drive reamers in operation.

E. Gairing, president; C. E. Wyrick, general mgr.; B. O'Meara, asst. mgr. of sales; D. G. Hawksworth, asst. chief engineer; William B. McClellan, Detroit representative.

Gallmeyer & Livingston Co. 2B 15. Grand Rapids hydraulic feed surface grinders, hand feed surface grinders, Universal cutter and tool grinders, twist drill grinders, tap grinders, combination twist drill and tap grinders and other types of grinders.

C. H. Gallmeyer, treasurer; S. Owen Livingston, vice-president; B. C. Saunders, secretary; J. DeKoning, engineer.

Gardner Machine Company. 1W 20. No. 9 40 in. super disc grinder in operation, grinding coils springs; No. 84 special automatic hexagon nut grinder in operation, grinding hex nuts; No. 86 30 in. horizontal grinder with hand operated swinging work table; No. 3-CB "Speed-U-Need" polishing lathe; No. 3-DA double spindle "Speed-U-Need" polishing lathe.

L. W. Thompson, president; F. E. Gardner, vice-president; W. B. Leishman, treasurer and sales mgr.; B. H. Pratt, superintendent of service; F. M. Risler, Detroit mgr.; Harold Prigoff, eastern mgr.; H. J. Gaumond, P. L. Watson, W. L. Townsend, H. C. Steinbuck and A. B. Davenport, Jr., sales engineers.

W. Gaterman Mfg. Co. 5C 2a. Pneumatic oscillating tapping machines.

W. Gaterman, president; E. Gaterman, secretary and treasurer; F. H. Kind, master mechanic.

Gears & Forgings, Inc. 3W 15. Gears; forgings; reduction units; machine tool parts; transmissions.

R. B. Tripp, gen. sales mgr.; R. K. Plummer, asst. sales mgr.; C. E. Broome, district sales mgr.; H. J. Awig, engineer.

General Electric Co. 4A 2. Motors and control applicable to machine tools.

The General Radial Drilling Machine Company. 2W 14. 5 ft. 15 in. column hydraulic radial drill; 3 ft. 9 in. column sensitive radial drill.

R. B. Busch, president; J. Schaffner, chief engineer.

The Geometric Tool Co. 1W 21. Self opening die heads: style D for hand machines; KH for hand machines; DS for Brown & Sharpe automatics; KD rotary heads for live spindles; special purpose tools; collapsing taps receding chaser taps; solid adjustable die heads; solid adjustable taps; threading machines;

chaser grinder; chaser grinding fixture.

James W. Sneyd, vice-president; G. A. Denison, sales mgr.; P. A. Pritchard, sales engineer; L. G. Spealman, production engineer.

Giddings & Lewis Machine Tool Co. 2C 11. No. 50 extra heavy table type high pressure power Precision horizontal boring, drilling and milling machine.

C. Gebuhr, R. H. McCormick, A. E. Ulrich, A. L. Carlson, E. E. Wagner.

Gisholt Machine Company. 1C 4. Turret lathes; automatic chucking machines; balancing machines, and a tool grinder.

W. J. Hannum, George M. Class, F. M. Long, L. E. Godfriaux, W. I. Senger, C. B. Carr, G. E. Thomas, R. D. Heflin, H. G. Hall, R. E. MacCartney, J. H. Nebel, A. S. Beckman, U. S. James.

Gits Bros. Mfg. Co. 5A 8. Oil cups; oil hole covers; sight feed lubricators; high pressure grease cups; multiple feed oilers; high pressure grease gun and fittings.

R. J. Gits, president; Frank Zeman, sales mgr.; J. A. Gits, general superintendent.

Gleason Works. 1B 4. Three in. spiral bevel gear generator; 10 in. manufacturing spiral bevel gear generator; 15 in. spiral bevel gear generator; 30 in. spiral bevel and hypoid generator; 4 in. spiral bevel cutter sharpener; 12 in. spiral bevel cutter sharpener; cutter angle testing device; 3 in. straight bevel gear generator; Universal manufacturing bevel gear generator; 12 in. straight bevel gear generator; generator tool grinder; four spindle manufacturing rougher; Multiple spindle rougher cutter sharpener; 18 in. combination testing and lapping machine.

A. L. Stewart, chief engineer; S. H. Earl, works manager; B. H. Bickle, sales manager; F. E. McMullen, chief engineer—gear division.

Goddard & Goddard, Inc. 3W 13. Milling cutters, including special and standard classes in both form and profile type; Demonstration of cutting in alloy steel.

A. N. Goddard, president; E. E. Anderson, works mgr.; C. S. Goddard, sales mgr.; William Fritz, superintendent; K. W. Legg, and C. H. Wallace, sales engineers; E. E. Guntert, J. Murray, Henry Boggis, E. D. Rummins and Frank Willbrant, salesmen.

Goss & De Leeuw Machine Co., 1B 3. 6″ and 11″ G & DL tool revolving multiple spindle automatic chucking machine; No. 6 work revolving multiple spindle automatic chucking machine.

Stanley T. Goss, president; Val. C. Hart and J. J. Spring, sales engineers; H. J. Hauck, engineer.

Gould & Eberhardt, 1B 6. No. 9H Universal manufacturing gear hobbing machine; 12HS manufacturing gear hobbing machine; 48HS manufacturing gear hobbing machine; 24″ manufacturing shaper with Universal table; 36″ manufacturing shaper.

F. L. Eberhardt, president and gen. mgr.; H. Ezra Eberhardt, secretary; William F. Zimmerman, chief engineer; Gustave Spies, sales engineer; F. G. Eberhardt, John Duffy, John Allwood, James Craig and Albert Miller, sales representatives.

Greenfield Tap & Die Corp., 3W 9. No. 12 Greenfield high speed internal grinder; No. 1 hydraulic plain grinder; No. 3 motor-in-head cutter and reamer grinder; No. 734 threading machine with automatic opening die head; snap, plain and thread gages; "Acorn" and button dies; ground and cut thread taps; twist drills; screw slotting cutters; reamers; pipe tools.

W. B. duMont, vice-president in charge of sales; R. B. Hubbell, mgr. machine tool dept.; E. J. Bryant, mgr. gage & reamer dept.; Louis Battey, mgr. small tool dept.; A. M. Drake, chief engineer; F. Judge, general superintendent; C. C. Ziegler, mgr. Chicago district; C. H. Coe, mgr. New York district; B. G. Munyan, mgr. Detroit district; A. T. Ritchie, J. K. Penny, A. J. Kiehne and B. F. Butterfield, sales engineers; G. W. Demarest, railroad representative.

Greenlee Bros. & Co., 1B 2. Four Spindle automatic screw machines; multiple spindle drilling machine.

G. C. Purdy, president; J. H. Mansfield, chief engineer; A. H. Eggers, sales mgr.; L. H. Geddes, sales engineer; F. J. Hollem and J. C. Beers, factory representatives.

Gurney Ball Bearing Division, Marlin-Rockwell Corporation, 4W 14. Radial, Radial-Thrust and Thrust ball bearings; head stocks, a valve grinder, vertical electric motors and a reduction unit, all equipped with Gurney ball bearings.

H. A. Johnston, sales mgr.; Coleman Darnell, asst. sales mgr.; A. A. McGowen, advtg. mgr.; O. H. Koelker, D. K. Hatch, sales representatives.

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The Hall Planetary Co., 2W 11. Type B Planetary full automatic; type A Planetary illustrating various types of threads and bores; type D Planetary in production on internal milling; machinabilameter—a new instrument for testing the machineability of metals.

P. Hall, G. Stafford, H. C. Sheaffer, H. Leisner.

The Hammond Mfg. Co., 5A 2. Radial drilling and tapping machine; pedestal automatic tapping machine; cabinet base polishing and buffing machine; six spindle hydraulic drilling machine.

William D. Buss, J. J. Stephens, C. M. Allen, Glenn M. Hood.

Hanna Engineering Works, 3W 10. Hanna "Rapid" riveter—capacity ¼″ rivets cold; Hanna "Yoke" riveter — capacity ⅜″ rivets cold; Hanna "Closed Yoke" riveter for automobile chassis frame riveting; Hanna "Turret" riveter for automobile chassis frame riveting.

A. F. Jensen, president; J. C. Hanna, chief engineer; L. F. Weldon, O. F. Weiss, G. B. Lytle and E. J. Charron, sales representatives.

Hannifin Mfg. Co., 5B 9. Air operated chucks; air operated arbor presses; air operated rivet presses; air operated work holding fixtures; air operated vises; air control valves; air pressure regulating valves; air operated expanding mandrels; air clutch countershafts; stationary double acting air cylinders; hydro-pneumatic broaching presses; boring bars; air-operated devices.

V. W. Peterson, president; J. H. Sipson, asst. gen. mgr.; R. A. Bean, H. H. Mercer and E. D. Thompson, sales engineers.

The Hanson-Whitney Machine Co., 2B 6. Universal semi-automatic thread milling machine; Universal vertical tool and die shaping machine; rapid precision centering machine; taps, gages, hobs and screws, finished after hardening by the Hanson Process.

J. W. Johnson, C. A. Lauridsen, H. C. Chellman, E. A. Hanson, president; L. B. Reed, gen. mgr.; George McPherson, A. G. Brice, H. B. Morrison, E. H. Huntington.

Hardinge Bros., Inc., 2W 7. Bench lathes and attachments; bench millers; quick-change precision lathe.

J. F. Griswold, president; Henri E. Nelson, gen. mgr. machine tool div.; Henry C. Sharp, director of engineering; Edward A. Iverson representative.

The Heald Machine Company, 2A 7. No. 72A-3 "Size-Matic" internal grinding machine; No. 72A-3 "Gage-Matic" internal grinding machine; No. 72A-5 airplane cylinder grinding machine; No. 25A rotary surface grinder with 30 in. chuck.

J. N. Heald, Richard A. Heald, Roger N. Heald, S. T. Massey, W. Guild, R. A. St. John, J. R. Carlson.

The Hendey Machine Company, 1D 2. 12″x5′ high speed ball bearing lathe; 12″x5′ geared head lathe, taper attachment, oil pan, No. 3 drawing-in attachment; 18″x10′ geared head lathe, ball bearing spindle, taper attachment, subheadstock; 16″ heavy duty crank shaper; 32 in. heavy duty crank shaper; No. 12 hydraulic broaching machine.

S. H. Childs, vice-president & gen. mgr.; W. A. Reynolds, asst. to vice-president; A. H. Hall, sales mgr.; P. H. Buxton, superintendent; C. Bouillon and George Knight, engineers; H. Blakeslee and R. J. Peterick, asst. superintendents; W. F. Henly, New York branch mgr.; F. C. Parman, Rochester branch mgr.; E. B. Barker, Detroit branch mgr.; P. W. Rice, Chicago branch mgr.; R. B. Shaw, Dayton branch mgr.; F. J. McCarty, special representative.

The Henry & Wright Mfg. Co., 2W 4. Henry & Wright dieing machines (high speed automatic punch presses); multiple station progressive dies; high speed multiple-spindle sensitive drilling machines.

J. F. Funk, gen. mgr.; C. F. Sherman, chief engineer; J. J. Dale, western sales mgr.; R. B. Weeks, Cleveland district sales mgr.; C. H. Hamilton, Detroit rep.; F. H. Spiegel, western New York rep.; W. J. Henry, eastern sales manager.

Higley Machine Co., 2W 9. Higley 8″ capacity "Coldcut" sawing machine equipped with screw feed table for feeding heavy bars up to cutting position and swivel type front table with gauge stop to handle pieces being cut off and to guage the length of pieces being cut off.

L. M. Waite, general mgr.; I. S. Smith, sales mgr.; M. H. Waite, service manager.

Hill-Curtis Co., 2W 8. Electric grinders, bench and pedestal type; belted grinders, bench and pedestal type; electrically driven railroad journal wedge reclaimer; selective speed tool and productive grinders, electric; "Rite Speed"

electric polishing lathe; belted polishing lathe; disc grinders, electric.

W. C. Hammond, president; W. J. Holtmeier, sales mgr.; H. J. Kingsbury, chief engineer.

The Hisey-Wolf Machine Co., 2W 22. Electric drills, grinders, buffers.

John W. Friedlander, J. E. Hauser, Roy D. Haworth, C. J. Henefelt, Albert Kiefer, George Moerlein, P. A. Rebok, E. Ritz, Jr., T. R. Sanders, H. W. Wallace.

Hoefer Mfg. Co., 2W 1. 5-7½ H. P. production drillers; auxiliary heads.

Chester A. Hoefer, secretary; Paul Andree, general mgr.; Ernest Kracht.

E. F. Houghton & Co., 6B 4. Microstructure of steels after Society of Automotive Engineers' recommended heat treatment; "Houghtoclean" for metal cleaning; "Hocut" for metal cutting; Vim leather belting and leather packings; lubricating oils.

Hyatt Roller Bearing Co. 5A 5. Hyatt bearings for machine tool application; photographic illustration of bearing applications to machine tools ranging from board drop hammers to finishing tools of all kinds.

F. S. Darke, L. L. Hill, W. T. Long, L. F. Stuebe, sales engineers; C. L. Newby, mgr. industrial div.; Chicago; J. M. Kelly, mgr. Pittsburgh sales district; H. M. Carroll, advtg. manager.

The Hydraulic Press Mfg. Co., 3W 4. H-P-M- hydraulic and high-speed presses.

F. B. MacMillin, H. F. MacMillin, P. A. Harlamert, W. Ernest.

—I—

Illinois Tool Works, 5C 1. Milling cutters; hobs; reamers; broaches; ground form tools; die filing machines; tool testing fixtures; Wedgelock tool holders.

S. O. Bjornberg, P. J. Nelson, A. W. Swanson.

The Ingersoll Milling Machine Co., 1C 1. Ingersoll 4-head adjustable rail heavy pattern milling machine; open-side milling, boring and drilling machine; face mill cutter grinder; line of Ingersoll milling cutters.

Amos A. Braid, representative; Robert M. Gaylord, W. C. Sproul J. R. Johnson, A. H. Lyon, E. K. Morgan, H. C. Rose, F. J. Malone, J. M. B. Scheele, W. M. Grove, J. M. Macrae, G. L. Bradley, S. W. Fish, Walter Hangartner, Parnell Divine.

International Machine Tool Co., 1W 16. 1-H 24x5¼" "Libby-International" turret lathe with power feed cross slide turret; 3-H 29x8¼" "Libby-International" turret lathe with rigid turret.

O. B. Iles, T. P. Dickinson, Harry Heidergott, Alfred Ruwe.

The Iron Age, 5W 6a. The Iron Age —a weekly publication.

F. J. Frank, C. S. Baur, Emerson Findley, B. L. Herman, Pierce Lewis, C. H. Ober, W. B. Robinson, W. C. Sweetser, D. C. Warren, F. S. Wayne, C. E. LaChaussee, H. E. Leonard, O. Johnson, B. H. Hayes, A. I. Findley, W. W. Macon, E. F. Cone, G. L. Lacher, S. G. Koon, C. E. Wright, E. E. Thum, T. H. Gerken, F. L. Prentiss, R. A. Fiske, R. E. Miller, B. Finney, A. H. Dix, R. Derby, J. M. Hazen.

Iron Trade Review, 5W 9. Iron Trade Review—a weekly publication.

E. L. Shaner, C. J. Stark, J. D. Pease, H. Cole Estep, G. O. Hays, John Henry, E. W. Kreutsberg, E. F. Ross, J. D. Knox, H. B. Veith.

—J—

Jones & Lamson Machine Co. 1A 10. Hartness automatic dies and chasers, screw thread comparator, Hartometer; Flanders ground thread taps; chaser grinder.

R. E. Flanders, mgr.; H. S. Beal, asst. gen. mgr.; E. T. Bysshe, chief engineer die div.; E. F. Lockwood, H. G. Taylor, H. A. Trimble.

2C 6. Hartness 2¼ x 24 in. turret lathe for bar work; 3 x 36 Hartness turret lathe for chucking work; 14 in. standard Fay automatic lathe for second operation on clutch gear; 14 in. standard Fay automatic lathe for finning operation on airplane cylinders; 14 x 50 in. Fay automatic lathe with center drive tooled to machine large truck rear axle in one operation; 24 x 42 in. Fay automatic lathes for the machining of large shaft flanges.

R. E. Flanders, mgr.; H. S. Beal, asst. gen. mgr.; J. E. Lovely, chief engineer Fay dept.; W. F. Howard, F. W. Lodge, C. A. Erskine, B. L. Billings, A. L. Currie, H. C. Miller, F. A. Parker, G. J. Keller, F. L. Watkins, A. V. Wiggins, J. C. Price, C. H. Seaver, J. C. Hebert, J. L. Reilly.

—K—

Kane & Roach, Inc., 3W 14. Literature and motion picture display of Kane & Roach equipment.

W. E. Kane, president; R. C. P. Kane, vice-president; H. W. Kane, secretary; H. Wier, engineer.

Kearney & Trecker Corporation, 2B 7. No. 2 Standard Universal Milwaukee milling machine; No. 2 rotary vertical Milwaukee milling machine with Skip-Stop rotary table; No. 1402 "Milwaukee-Mill" Simplex; No. 2207 Bridge-Type "Mil-waukee-Mil."

Theodore Trecker, president; E. J. Kearney, secretary and treasurer; George L. Erwin, Jr., sales mgr.; M. J. Schmitt, asst. sales mgr.; C. M. Cheadle, Jr., advtg. mgr.; C. R. Hochmuth, rep. in Charge of exhibit; William K. Andrew, production service engineer.

Keller Mechanical Engineering Corp., 2C 3. Type BL-2416 Keller full automatic tool room machine equipped with two-template rigging and attachment for locating and jig boring; No. R6 cutter and radius grinder, a "Kellocater" complete unit with over-arm and spindle equipped with power feed; "Kellerflex" flexible shaft machines for nut setting and screw driving.

Henry Schreiber, J. F. Keller, president; Charles Bitter, Detroit rep.; Paul Renno, Chicago, rep.; W. L. MacRae, New York State rep.; E. D. Ashley, New England rep.; Arthur Jenner, New Jersey & Pennsylvania representative.

Kelly Reamer Co., 5W 12-13. Boring and reaming tools, including special production tools for boring and reaming and multiple cutting; turret lathe; drill press; horizontal boring mill; vertical turret lathe equipment for all types of work, particularly for cylinder crankcase and also multiple cutting operations (all tools are adjustable and interchangeable).

H. C. Putnam, president; E. W. Putnam, vice-president and general mgr.; D. E. Van Deusen, sales mgr.; A. H. Howard, sales engineer.

The Kempsmith Mfg. Co. 1B 7. Milling machines.

Robert J. Wilson, Frank Wollaeger, L. J. Radermacher, H. L. Livesay, Charles Watson, A. E. Nieman, Walter Mickelson, Hugo E. Czerwonky, R. F. Shaw.

The Kent Machine Company. 5A 1a. Six spindle horizontal driller; double head countersinker; bar pointer; stud threader.

A. B. Babbitt, secretary and sales mgr.; A. F. Sinclair, factory manager.

Keystone Lubricating Co. 6A 2. Keystone safety lubricators; Pneuma-Lectric lubricating system; grease cups; greases (solid and semi-solid cup greases, and liquid greases for ring oil bearings).

H. A. Buzby, president; George W. Hall, Pittsburgh district sales mgr.; Peter Cassady, Chicago district sales mgr.; C. O. Norstrum, engineer; Philip King and H. M. Ludwick, lubricating engineers; Vic Berguson, Cleveland rep.; R. C. McDaniels, Pittsburgh rep.; G. W. Quinn, Syracuse rep.; M. C. Schwenk, Detroit representative.

The King Machine Tool Company. 1A 2. Heavy duty vertical boring and turning mills.

E. A. Muller C. F. Muller, I. Herbst, H. Glensman.

Kingsburg Machine Tool Corp. 2W. 10. Automatic multi-spindle indexing machine for drilling, reaming and tapping with pneumatic synchronization of spindle stroke and index, automatic two spindle vertical drilling and burring machine; automatic three spindle dial feed tapping machine; type EC opposed spindle drilling and tapping machine; model 30 drilling head; model 30 T. tapping head.

E. J. Kingsbury, president and treasurer; G. Swahnberg, chief engineer; J. E. Anderson, factory mgr.; H. B. Jones and G. G. Hathaway, sales engineers.

W. B. Knight Machinery Co. IW 10. No. 4 and No. 2 Knight millers; set of dial indicators mounted on No. 4 miller for jig boring; high speed, horizontal, shaping, circular milling and index attachments for use on either No. 4 or 2 millers.

H. E. Knight, vice-president; Robert Smith.

—L—

William Laidlaw, Inc. 5B 3. Types CM 30-in., JM 20-in., and SM 20-in. metal-cutting bandsaws.

William Laidlaw, president; E. O. Jenkins, sales manager.

Landis Machine Co. 1B 8. ¾ in. Landis automatic forming and threading machine; 6" Landis pipe threading and cutting-off machine, motor driven; Lanco heads for automatic, semi-automatic and hand operated threading ma-

chines; Landmatic heads for turret lathes and hand operated screw machines; Victor collapsible taps for internal threading; Victor receding chaser collapsible taps for internal threading; Victor adjustable taps.

C. N. Kirkpatrick, sales mgr.; G. M. Stickell, asst. sales mgr.; R. G. Mumma, mgr. Victor plant; S. W. Mathias, engineer; J. T. Benchoff, mgr. Cleveland office; M. B. Henneberger and J. I. Davis.

Landis Tool Company. 1W 18. Hydraulic cam grinder; hydraulic oscillating grinder; plain hydraulic grinder; hydraulic crank grinder.

R. F. Ingram, sales mgr.; Paul Stoner, sales engineer; F. W. Pensinger, advtg. mgr.; A. P. Steiner, chief engineer; C. M. Talhem, F. M. Gertiser and Wm. Ibsen, salesmen.

La Salle Tool Co. 3W 12. No. 824 full electric automatic surface grinder; No. 3 electric surface grinder; No. 1 electric plain and surface grinder.

F. S. Knowles, president; John C. Kopf, gen. manager.

R. K. LeBlond Machine Tool Co. 2C 1. No. 12 LeBlond heavy duty automatic lathe, texrope motor drive; No. 16 heavy duty automatic lathe; texrope motor drive; 11″x4′ rapid production lathe with facing attachment, pan, pump, belted motor drive; 25″x12′ heavy duty geared head engine lathe with geared motor drive; 15″x8′ heavy duty geared head tool room with relieving attachment, draw-in attachment, taper attachment, pan, pump, and texrope motor drive; 16″x5′ rapid production lathe with plain rests, rapid power traverse, pan, pump, belted motor drive; No. 1 cutter grinder with all attachments.

H. C. Pierle, sales mgr.; William F. Groene, vice-president; B. N. Brockman, western rep.; William E. Groene, eastern rep.; C. C. Carr, European rep.; Dave Mills, estimator; W. L. Rybolt, advtg. manager.

The Lees-Bradner Company. 3W 1. Thread millers and gear cutters.

E. J. Lees, H. C. Young, T. E. Lord, R. A. Zilm, C. H. Eden.

Lehmann Machine Company. 2W 24. Geared head, motor driven engine lathe; gear lapping machine.

Paul Lehmann, A. H. Lehmann.

Leland-Gifford Co. 2B 1. 12″ one spindle belt and motor spindle sensitive drill; 14″ two spindle sensitive drill; 24″ two spindle belted drill.

S. B. Dowd, sales mgr.; H. P. Sawtell, D. H. Boothby, C. H. James, E. D. Baldwin, E. A. Heidlinger, T. A. Poutter, W. E. Fors, E. F. McCaffery.

The Lincoln Electric Co. 5A 3. Electronic tornado automatic welder in action; Stable Arc welder in action; "Linc-Weld" motors and welders' supplies.

A. F. Davis, vice-president; R. P. Tarbell, O. P. Hanchette, F. W. Kessler, R. B. Tuhey, Morris R. Taylor, E. H. Bergstrom.

Link-Belt Company. 4C 1. Link-Belt silent, roller and malleable chains and sprocket wheels; automatic idler for use with Link-Belt silent chain drives applied to main and integral shaft of machine tools; Link-Belt Paradox showing detailed action of silent chain on wheels; herringbone speed reducer in operation.

J. S. Watson, vice-president; R. S. Dyson, special engineer; E. H. Smedley, sales engineer; F. H. Dalrymple and R. Wainright, Cleveland sales dept.; H. R. Cunning, L. Spillan, engineer speed reducer department.

The Lodge & Shipley Machine Tool Co. 2B 11. 14″x6′ Selective head tool room lathe; 18″x8′ Selective head manufacturing lathe; 24″x12′ lathe.

J. W. Carrel, H. J. Breitenbach, T. C. Stephens, W. L. Dollo, L. E. Eberts, H. M. Kordenbrock, J. E. Kordenbrock.

Logansport Machine Co. 1W 9. Air operated work holding devices, including air operated chucks; chucking devices; rotating and non-rotating cylinders; arbor presses; milling and drilling vises; control valves.

F. B. Wilkinson, president; Frank G. Payson, gen. mgr.; J. C. Cotner, sales engineer; Andrew Michael, asst. superintendent.

The Lucas Machine Tool Co. 1W 17. No. 42 "Precision" horizontal boring, drilling and milling machine; No. 41 "Precision" horizontal boring, drilling and milling machine with dial indicator indexing device; 30 ton Lucas power forcing press.

H. M. Lucas, president; G. A. Yost, secretary; J. A. Leighton, sales mgr.; F. P. Sprague, R. L. Glaser and R. G. Goring, sales representatives; L. Reulbach.

Ludlum Steel Company. 6A 4. Steel and tungsten carbide; mill and fabricated forms; Enduro Nirosto steel; Nitralloy; tool steels; forgings; Strauss metal.

H. G. Batcheller and F. B. Lounsberry, vice-presidents; A. F. Dohn, sales mgr.; C. B. Templeton, asst. to president; H. A. DeFries, metallurgist; W. Westover, advtg. mgr.; H. I. Askew and J. C. Gearhardt, H. Hardwicke, G. Peterson.

—M—

Machinery. 1E 1. Machinery — a monthly publication.

C. Edgar Allen, Victor Brook, Freeman C. Duston, Edward K. Hammond, Charles O. Herb, Harry B. Hurlburt, Franklin D. Jones, Alexander Luchars, Robert B. Luchars, Erik Oberg, Louis Pelletier.

Madison-Kipp Corporation. 5W 11. Fresh oil systems automatic centralized lubrication devices; automatic die casting machine films.

A. T. Lilligren, sales mgr.; J. A. Coleman, vice-president; J. A. Courter, eastern sales mgr.; T. E. Coleman, president; W. G. Coles, chief engineer; T. C. Korsmo, chief engineer of die casting division.

Manning, Maxwell & Moore, Inc., Putnam Machine Works. 2B 5. Putnam 72″ rotary continuous milling machine and 36″ type "K" rotary slitting machine.

F. H. Walsh, E. L. Fickett, R. G. Holmes, J. H. Welch, W. A. Deems, F. P. Scott, O. B. Schmeltz.

Marschke Mfg. Co. 4B 1. Universal portable electric tools; high cycle portable electric tools; Marschke grinders and Marschke swing frame grinders.

W. C. Allen, R. D. Black, R. E. Mizener, G. M. Buchanan, A. M. York, Lee H. Hind, Gus Fischer, Ralph Herrick, J. A. Fairfield, Luke Boyd, W. J. Fenwick, W. T. Johnston, Guy J. Coffey, C. C. Watts, W. S. Talbott.

McCrosky Tool Corporation. 5W 14. McCrosky-Super adjustable reamers and reaming bars; boring heads; Wizard quick-change chucks and collets; friction drive tapping collets; safety tap holders; McCrosky turret tool posts for lathes; self - centering steady - rests; "Neva-Stop" face plates; Tungsten-Carbide turning tools.

F. P. Miller, president; R. W. Thomas, gen. mgr.; C. M. Sutton, sales mgr.; Frank Walster, shop superintendent; S. P. Miller, treasurer; Louis Skeel, engineer; W. J. Greenleaf, I. F. Belknap, A. J. Moore, Fred Fisher; I. C. Cameron, Arthur Fell and Frank Findlay.

Michigan Tool Co. 5A 4. Michigan Tool Company milling cutters, hobs, gear shaper cutters, special tools; Colonial Tool Company round, spline, and combination round - and - spline broaches; spline gauges.

Otto Lundell, president and gen. mgr.; Michigan Tool Co.; O. L. Bard, secretary, Michigan Tool Co.; J. W. Mull, Jr., sales manager, Michigan Tool Co.; C. J. Halborg, general manager, Colonial Tool Co.; E. H. Kurtz, sales manager, Colonial Tool Company.

Mill and Factory Illustrated. 5C 2. Mill and Factory Illustrated—a monthly publication.

Harvey Conover, Jr.; B. P. Mast; E. M. Stanley; Morgan Farrell.

Modern Machine Shop. 4W 8. "Modern Machine Shop."

Don G. Gardner, publisher; Howard Campbell, editor.

Modern Machine Tool Co. 5B 6. Combination drill table and vise as applied to standard drill presses, electric drill presses and radial drills.

H. G. Walker, mgr.

Moline Tool Company. 2C 9. No. 115-D hydraulic feed driller equipped with twelve standard BV Type heads; No. 114-U driller equipped with twelve Universal joint heads.

Wilson P. Hunt, C. R. Rosborough, Franklin Johnston, A. E. Lindberg, O. R. Reller, Willis C. Kuschmann, S. L. Brandenburg, R. H. Branderburg, Louis Hallene, C. W. Hallene, C. E. Parkhurst, A. L. Sackett, Floyd Brown.

The Monarch Machine Tool Co. 2W 21. 1—16″x6′ Monarch model "AA" heavy duty helical geared Timkenized high speed lathe; 1—16″x30″ model "C" sixteen speed helical geared completely Timkenized tool room lathe with full equipment; 1—24″x10′ model "N" sixteen speed extra heavy duty helical geared Timkenized lathe; hydraulic automatic lathe.

W. E. Whipp, vice-president and gen. mgr.; F. C. Dull, secretary and asst. gen. mgr.; P. A. Abe, gen. superintendent; C. A. Bickel, chief engineer; C. L. Cameron, J. W. Dunn, S. Brandenburg.

Morse Chain Co. 5W 10a. Morse silent chain drive; flexible couplings; speed reducer; device showing action of rocker joint; methods of lubrication.

A. B. Wray, sales mgr.; D. B. Perry, works mgr.; R. L. Phillips, R. J. Koch.

Morton Mfg. Company. 3W 19. Morton 48″ stroke high duty draw-cut

shaper with variable speed transmission; 18" stationary keyway cutter; "Hi-pro" keys; Robinson air hose couplings.

Henry E. Morton, president; G. F. Goble, mechanical engineer; F. Frank Bliss, rep.; H. Earl Morton, general superintendent; Matt. H. Morton, asst. to president.

Murchey Machine & Tool Co. 2W 23. Collapsible taps; self-opening die heads.

W. C. Beechner, sales mgr.; P. F. Zerkle, J. H. Coyle.

—N—

The National Acme Co. 1B 5. 4" Gridley automatic four spindle chucking machine; 1¼" Gridley automatic four spindle bar machine; ⅝" Acme automatic five spindle bar machine; centrifugal oil clarifying and separating machine; self-opening dies; collapsing taps.

A. E. Drissner, chief engineer; A. E. Henn, mgr. machinery sales dept.; H. F. Fussner, mgr. die & tap sales dept.; A. O. Bredemere, W. A. Johnson, R. J. Preston, W. G. Furlong, E. C. Lange.

The National Automatic Tool Co. ID 1. Multiple spindle way driller; multiple spindle wap tapper; vertical hydraulic single spindle heavy duty driller; vertical hydraulic multiple adjustable spindle driller; vertical single spindle Hi-duty gear feed driller; small multiple spindle driller; Universal joints.

H. W. Bockhoff, president; H. C. Hunt, secretary; E. D. Frank, sales mgr.; E. A. Herrcke, asst. sales mgr.; R. M. Galloway, chief engineer; M. L. Strawn, C. G. Dvorak, G. E. Moote, W. F. Hart, C. H. Briggs, G. W. Schepman, T. C. McDonald, E. H. Flook.

National Machinery Co. 1A 8. National 1¼" high duty heading and forging machine; ⅛" automatic nut tapper; ⅜" automatic nut tapper.

National Twist Drill & Tool Co. 4B 5. Interlocking slab milling cutters, heavy duty parabolic type; staggered tooth side milling cutters; inserted blade high duty face milling cutters; twist drills; reamers; milling cutters; hobs; special tools; taps; dies; screw plates.

Harry Butler, asst. mgr. of sales; George Ringstad, advtg. mgr.; C. J. Oxford, chief engineer; W. R. Crook, Cleveland branch mgr.; H. C. Toomey, Cleveland sales rep.; C. Cornwall, Pittsburgh rep.; H. W. Springer, H. L. McGregor, president; C. E. Smith, vice-president and sales manager.

New Britain-Gridley Machine Co. 2A 3. No. 38 New Britain single-spindle, hydraulically operated work rotating chucking machines.

Booth 2W 26. No. 23-A New Britain four-spindle air operated tool rotating automatic chucking machine; No. 454 four-spindle "New-Matic" work rotating automatic chucking machine; No. 506 six-spindle 1¼" automatic screw machine.

H. H. Pease, president; Edward L. Steinle, vice-president and sales mgr.; George O. Gridley, E. H. Wheeler and D. H. Montgomery, vice-presidents; R. S. Brown, secretary; Frank Rau, in charge of booth; T. C. Stirling, G. K. Atkinson, L. E. Jolls, James W. Barr.

The New Departure Mfg. Company. 5W 5. New Departure bearing equipped spindle for vertical multiple spindle automatic; ball bearing equipped spindle and cylinder for large six spindle automatic; ball bearing equipped small high speed internal grinder spindle; bearing equipped tailstock live centers of various sizes; various types of ball bearings used in machine tools.

F. G. Hughes, vice-president; T. C. D. Crow, chief engineer; J. H. Beninger, asst. chief engineer; F. W. Marschner, Detroit sales mgr.; G. W. Fowler, Chicago sales mgr.; L. H. Gaylord, sales engineer.

Niagara Machine & Tool Works. 3W 20. Niagara No. 68-B double crank power press, geared, four piece tie rod frame; No. 56 straight side single crank press, geared, four piece tie rod frame; No. 696 power gap squaring shear; No. 4½ inclinable power press, plain, flywheel type; new type No. 340 slip roll former; No. 172 electric combination machine with interchangeable rolls for beading, crimping, turning, wiring, burring, edging and slitting.

Russell J. Caplin, Dolph F. Lindgren.

The Niles Tool Works Company. 2D 1. 36 in. and 44 in. side head boring mill; 27" "Time Saver" lathe; 62" boring and turning mill.

G. A. Rentschler, O. S. Ackley, L. C. Cole, A. C. Wais, A. T. Kuehner, J. E. Peterson, G. R. Shields, Harry Evans, Walter Brown, Carl Stomps.

The Noble & Westbrook Mfg. Co. 5W 3. Power and hand operated marking machine for general purposes; rapid production single purpose marking machines; steel marking dies; steel stamps; automatic numbering heads.

R. H. Noble, works mgr.; H. B. Knoble, superintendent; F. Berthold Helander, sales engineer; George Westbrook, president.

Norma-Hoffmann Bearings Corporation. 4W 4. Ball, roller and thrust bearings; machine tools of the smaller sizes with sectioned bearing mountings; photographs of machine tool applications; Norma minimeter (a precision measuring instrument); Hoffmann bearing pedestals.

O. P. Wilson, vice-president; G. R. Bott, eng. mgr.; D. E. Batesole, asst. eng. mgr.; Harry L. Day, factory superintendent; C. A. Baden, plant engineer; H. J. Ritter, asst. secretary; R. E. Hecker, Cleveland district mgr.; C. D. Kilham, sales engineer; T. J. Harley.

Norton Company. 2A 10. Crankpin grinding machine, hydraulic drive; crankshaft bearing grinding machine, hydraulic drive; plain cylindrical grinding machine, hydraulic drive, 10x48" size; open side surface grinding machine, hydraulic drive, 6x10x48" size; type A cylindrical grinding machine equipped with hydraulic wheel slide movement; type No. 50 crankshaft lapping machine; type No. 15-C cylindrical lapping machine.

W. L. C. Neilson, vice-president and gen. sales mgr.; G. N. Jeppson, vice-president in charge of manufacture; H. W. Dunbar, works mgr.; C. H. Norton, consulting engineer; A. G. Belden, chief engineer; S. Player, lapping machine engineer; R. A. Cole, experimental engineer; W. T. Montague, sales mgr.; H. J. Griffing, asst. sales mgr.; H. P. Chace, sales engineer; H. Wickstrom, field engineer; H. N. Harding, European sales rep.; A. R. Sandine, Cleveland mgr. grinding wheel div.; John Cook, C. H. Hill, O. A. Knight, M. E. Mattson, G. C. Montague, O. E. Nordstrom, F. W. Smith, C. W. Atwood, H. S. Bowler, W. D. Briggs, H. O. Hedlund, E. W. Hellstrom, H. L. Swainey, G. B. Taft, G. E. Hulbert.

—O—

Oakite Products, Inc. 4W 1. Literature and data pertaining to the cleaning of metals, cutting, grinding, rust-prevention, and stripping finishes.

H. L. Gray, A. W. Perry, L. B. Johnson.

The Oesterlein Machine Co. 1A 13. No. 36 "Milomatic" (an automatic hydraulic reciprocating and indexing bed type milling machine); 28" tilted offset miller; 48" tilted offset miller; No. 2 Universal standard miller, No. 2 grinder.

C. D. Oesterlein, Charles Freudenthaler, A. H. Merschel, David F. Noble, G. A. Richey, Carl Kline.

The Ohio Machine Tool Co. 2D 8. 36" Super-Dreadnaught shaper; 24" dreadnaught shaper; Swift No. 35 flue welder; No. 6 combination copper and steel welder; No. 12 automatic welder; No. 16 projection welder.

Charles C. Swift, Cecil J. Davis, F. E. Taylor, H. A. Woofter.

The Oilgear Company. 2A 5. Oilgear 25 ton Gooseneck type straightening press; twin-12 horizontal broaching machine; automatic variable delivery machine tool feed equipment.

H. M. Swigart, president; W. D. Creider, gen. mgr.; G. H. Fobian, sales mgr.; J. P. Ferris, chief engineer; Ernst Weidman, mechanical engineer; E. C. Wollaeger, Donald Clute, W. G. Prasse, E. H. H. Graf and M. E. Engebretson, sales engineers; Frank Kuhagen and A. Hoffman, demonstrator; J. O'Rourke, chief shop inspector; L. M. Gross, pump shop foreman.

The O. K. Tool Co., Inc. 4B 7. O. K. metal cutting tools, lathe planer, boring mill and boring tools and holders; including inserted blade milling cutters; boring and facing heads; hollow mills and multiple operation tools; operating No. 5 Cinci-Hydromatic milling machine with O. K. milling cutters.

R. R. Weddell, chief engineer; F. S. Schroeder, service rep.; J. W. Costello, L. F. King.

Oliver Instrument Company. 1W 6. No. 51 Oliver drill grinder; "Arc" face mill grinder No. 2; drill point thinner; tap grinder; No. 21 drill grinder; S-4 die making machine; heavy duty die making machine.

E. C. Oliver, Robert J. Sack.

The Oster Mfg. Co. 3W 17. Pipe and bolt threading and cutting-off tools and machines.

A. S. Gould, secretary; R. E. Hyde, chief engineer; R. E. Willis and R. J. Oster, sales representatives.

—P—

Peerless Machine Company. 1A 11. Metal sawing machines of 6 ft. 6 in. and 9"x9" capacity, Peerless Universal type;

metal sawing machines of 14 in. x 16 in. capacity for heavy duty work, and billets and large diameters of metal; Chicago No. 2 power pipe threading machine ¼" to 2" capacity; Universal No. 2 portable pipe cutting and threading machine of ¼" to 2" capacity.

Charles Rasmussen, president; I. M. Ward, vice-president; R. T. Ingalls, secretary-treasurer; O. M. Jensen, superintendent; A. H. Goetz, sales manager.

Porter-Cable Machine Co. 1W 19. Manufacturing lathe; Universal milling machine attachments; portable electric hand belt grinders; portable electric hand saws; two-way belt grinder; flexible belt grinder; spindle sander; disc grinders and sanders; horizontal disc grinder.

D. J. Ridings, sales mgr.; A. N. Emmons, chief engineer; E. A. Herrig, engineer; F. P. Morrow, district rep.; G. H. Potts, representative.

Potter & Johnston Machine Co. 3W 6. Automatic chucking machines; automatic chucking or turning machine.

Norman R. Earle, mgr. of sales.

Pratt and Whitney Company. 2D 1. 13x30" model B lathe equipped with full relieving attachments, speed reducer, collets, chucks, etc.; 16x36" model B lathe equipped for turning demonstrations of all sorts; 20x48" model B lathe equipped for turning demonstrations of all sorts; bench machine tool equipment including a P & W bench lathe, No. 3 Universal bench miller, No. 0 Sigourney drill arranged on a bench with complete countershafting and full attachments; 14" vertical surface grinder with complete standard equipment including magnetic chucks; 6" vertical shaper, model B with complete standard equipment and all attachments; 12" vertical shaper, model B with complete standard equipment and all attachments; No. 1A jig borer with complete regular equipment and full attachments including indexing table; No. 3A jig borer with complete regular equipment and full attachments including indexing table; complete tool cabinet containing all tools, gages and devices necessary for operating Pratt & Whitney jig borers; No. 2 Vertical Automatic completely tooled up for a production job; six-spindle vertical deep hole driller completely tooled up for a production job; complete line of gages; small tools; taps, dies, reamers, etc.

C. R. Burt, vice-president and gen. mgr.; W. P. Kirk, gen. sales mgr.; Charles M. Pon, mgr. small tool and gage divisions; David Ayr, mgr. machinery div.; Frank Hoagland, master mechanic; A. H. d'Arcambal, sales mgr. small tools and gages; E. C. Shultz, advtg. mgr.; Wm. Law, sales engineer; Harold Welch, mgr. New York sales office; M. S. Bradley, mgr. Niles-Bement-Pond Co. of Mass.; William Hunter, mgr. Philadelphia sales office; P. C. McBeth, mgr. Pittsburgh sales office; H. William Kopf, mgr. Detroit sales office; R. W. Henke, mgr. Cincinnati sales office; J. D. Allan, mgr. Cleveland sales office; Frank Schreiner, Cleveland sales office; D. S. Woods, Chicago sales office: B. A. Donahue, St. Louis sales office; L. A. Quinn, Birmingham sales office; D. D. Brumbaugh, mgr. Rochester office.

Producto Machine Co. 1W 14. No. 50 "Producto-Matic" milling machine equipped with a four-station flat turret type of work holding fixture; No. 12 automatic single-spindle cam miller.

N. M. Marsilius, president; E. A. Harper and A. J. Cummings, vice-presidents; M. E. Gombar, engineer.

Thomas Prosser & Son. 4C 6. "Widia" Tungsten Carbide lathe tools; planer tools; shaper tools; drills; reamers; milling cutters; boring tools; special tools.

R. D. Prosser, gen. mgr.; W. E. Guild, sales mgr.; E. R. S. Reeder, mgr. special contracts; J. A. Deakin, sales engineer.

—Q—

Q-C Engineering & Tool Sales, Inc. 4A 6. Airflex riveting hammers; "Roto" live centers; Q-C drill bushings and locating pins; quick-clamp standardized fixture units; engineering service.

A. H. Pearson, president; A. M. Sargent, asst. gen. mgr.; R. E. Bloye, mgr. Chicago office; R. W. Burgess, mgr. eastern office; and G. D. Scott, chief engineer.

—R—

Racine Tool & Machine Company. 2W 20. 10"x10" Racine shear cut production saw; 6"x6" shear cut production saw, screw feed; 6"x6" gravity feed high speed saw; 4"x4" Junior saw; Duplex band saw. All motor driven and in operation.

M. E. Erskine, president; E. R. Larson, district sales mgr.; J. S. Toohey, designer; William Reinhardt, superintendent; P. F. Schatzman, Ohio rep.; S. P. Schafer, eastern rep.; P. O. Ott, designer; R. Fuller, demonstrator.

Ramsey Chain Co. 4 W3. A tachometer exhibit showing lack of friction in chain; panel exhibit showing three Ramsey silent chains operating on small sprockets.

D. I. Wheeler, sales mgr.; H. N. Davis, mgr. Cleveland branch; Daniel Kessler, mgr. Chicago branch; F. H. Trombley, sales engineer, Cleveland branch.

Reliance Electric & Engineering Company. 6A 6. Reliance type T heavy duty D.C. motors and fully enclosed fan cooled motors.

R. O. Herbig, R. A. McDowell, J. W. Corey, C. L. Peterson, H. H. Howard.

Reed-Prentice Corporation. 2W 2-3. No. 3 Reed-Prentice new model high speed ball bearing vertical milling and die sinking machine; 16" new model Reed-Prentice sliding gear head lathe; No. 5 Reed-Prentice new model vertical milling and jig boring machine.

R. C. Blackinton, chief engineer; F. W. McIntyre, vice-president; D. C. Forsman, Detroit sales mgr.; A. W. Schneider, works mgr.; G. W. McIntyre, New York sales mgr.; J. A. Benson, demonstrator.

Rickert-Shafer Co. 2C 10. Automatic single purpose threading machines; self-opening die heads; collapsible taps; automatic and semi-automatic tapping machines; chaser grinders; boring heads; chasers.

George E. Shafer, president; August A. Rickert, treasurer; Arthur A. Shafer, secretary; C. W. Howard, sales mgr. and rep.; J. W. Shea, service mgr. and asst. representative.

Rivett Lathe & Grinder Corp. 5B 5. Blanchard pulsating system for automatic oil lubrication for machinery; Forkup, Forkans, Forkguns for controlled oil lubrication, pressure grease appliances and systems.

Frederick C. Blanchard, chief engineer; Thorvald S. Ross, president.

Rockford Drilling Machine Co. 2W 25. Rockford "Two-Way" production boring machine; "Pullmore" industrial clutches.

E. C. Traner, W. W. Blomberg, J. L. Peterson.

Rockford Machine Tool Co. 2B 3. Rockford shaper-planer, 42" hydraulic driven; 24" Rockford Hy-service shaper.

Morris Monson, production mgr.; H. B. Newton, vice-president and general mgr.; R. C. Lind, president; A. B. Leet, chief engineer; J. G. Anderson, superintendent.

The Ross Mfg. Co. 4W 9. Mechanical emery wheel dressing and truing tools; machine cooling fluid pumps.

M. L. Klimo, W. C. Weslow, H. Joslin, D. Kelleher, H. P. Meyer, F. A. Centner.

Rotor Air Tool Co. 5B 8. Portable air drills, grinders, sanders and buffers.

H. P. Bailey, president; K. L. Pohlman, vice-president; R. J. Cook, factory rep.; W. G. Baily, Cleveland district mgr.; F. B. Engeln, sales department.

Joseph T. Ryerson & Son, Inc. 2D 2. No. 3, 4 and 7 Ryerson combination shear punch and coper for punching, shearing, coping and notching structural shapes, plates, bars, etc.; 300-ampere Wilson arc welder in operation in a glass booth; No. 2 Ryerson serpentine shear for cutting irregular shapes from sheet steel; Ryerson flue cutter and polisher and Ryerson flue roller (both machines used in the reclamation of locomotive flues by the butt welding process); Ryerson No. 0 high speed friction saw for cutting light metal shapes, mouldings, etc.; Ryerson No. 0 high speed friction saw with rotating attachment for cutting tubes, bars, etc.

A. G. Bryant, mgr.; A. P. Schumann, asst. sales mgr.; R. S. Armstrong, asst. sales mgr.; I. B. Yates and V. N. Towers, chief designers; Chicago Office: H. J. Aagaard, J. M. Lewis, F. J. Clark, F. G. Grosse, R. C. Page, D. MacArthur, J. C. Buckels, W. R. Sprague, T. W. Delanty, I. J. Vyduna, H. D. Broxon; Milwaukee office: E. J. Burki; St. Louis office: E. N. Carlson; Cincinnati office: A. L. G. Gentles; Detroit office: G. H. Merriell; Cleveland office: H. L. Robinson and O. A. Bloomquist; Pittsburgh office: J. A. Egbert and J. M. Eckes; Buffalo office: S. J. Johnson; New York office: M. C. Fidgeon, A. L. Nacke, R. H. Happersett; Philadelphia office: E. A. Lynch and H. M. Shaw; Richmond office: D. B. Parker; Houston office: D. S. Mair and C. J. Harter; Export office: P. H. Petersen.

—S—

The Safety Grinding Wheel & Machine Co. 2B 10. Heavy portable grinder (change speeds); change speed

—Alternating current motor drive "Rite Speed" floor grinders; conventional type motor driven floor grinders; grinding wheels for every purpose.

Charles W. Gwyn, president and mgr.; H. G. Weinland, secretary and mech. eng.; H. G. Bennett, W. H. Vance and C. A. Wampfler, salesmen; R. S. Dilliard.

Sebastian Lathe Co. 1W 24. 20 in. semi-automatic production lathe; 15 in. motor driven lathes; 11 in. motor driven lathe; 11 in. high speed production lathe.

E. E. Stokes, president; C. R. Cooper, purchasing agent; William Schroeder, superintendent; Ray Rece, operator.

Wm. Sellers & Co., Incorporated. 2A 6. No. 2A drill grinder, capacity 5/16 in. to 3 in. in diameter; drill point thinning machine, capacity ¼ in. to 3 in.; No. 1A tool grinding and shaping machine, capacity up to 3 in. x 3 in.; No. 2 tool grinding and shaping machine, capacity up to 1½ in. x 2 in.; No. 1 hob and cutter grinder for sharpening straight and spiral gashed hobs up to 12 in. long 12 in. diameter, reamers, taps, spiral milling cutters, etc.

Alexander Sellers, George H. Benzon, John D. McClintic, E. L. Holljes, Coleman Sellers, 3rd, J. C. Hinton, William Sellers, D. F. Robinson, A. Sellers, Jr.

Seneca Falls Machine Co. 1A 9. Seneca Falls turning equipment; "Lo-Swing" lathes; semi-automatic lathe; full automatic lathes, "Short-Cut" production lathes.

E. R. Smith, vice-president and gen. mgr.; J. A. Fyfe, secretary; P. Branigan, engineer; A. Schinkez, designer; F. E. Joel, works mgr.; F. C. Herbert, F. B. Webb and M. C. Day, sales engineers; W. H. Nettle, mid-west sales mgr.; G. E. Fogarty, European sales mgr.

The Sidney Machine Tool Co. 2W 6. 22 in. x 12 ft. Monotrol engine lathe; 16 in. x 6 ft. Monotrol toolroom lathe; 18 in. x 8 ft. Tritrol lathe; open Monotrol geared headstock.

A. C. Getz, gen. mgr.; B. A. Getz, sales mgr.; F. H. Dickas, chief engineer; A. L. Jennings, superintendent; L. S. Kirdy, demonstrator; W. A. McClure, salesman.

The Siewek Tool & Die Co. 6A 3. Exhibit in charge of O. H. Siewek.

Simonds Saw and Steel Co. 4B 4. Circular and band saws for cutting metal; files; "Red Streak" hack saws; "Abrasive" grinding wheels.

George T. Curtis, Harry P. Baumann.

S K F Industries, Inc. 4W 12. Ball and roller bearings for machine tools.

P. T. Hopper, W. F. Temple, R. Smith, P. R. Payson, F. E. Ericson, R. H. DeMott, W. Jetter, R. R. Zisette.

The Skinner Chuck Co. 4W 13. Lathe chucks of various sizes and weights; face plate jaws; drill press vises; milling machine vises; drill chuck; air chucks.

A. E. Thornton, asst. treasurer; D. M. Stevenson.

Sleeper & Hartley, Inc. 5A 1. No. 2 Universal spring coiling machine with wire reel.

W. H. Blount, sales representative.

The Smith & Mills Co. 2W 19. 1—25 in. back geared heavy duty crank shaper constant speed motor drive complete with 7½ H.P. motor; 1—12 in. single geared crank shaper constant speed motor drive complete with 2 H.P. motor.

J. E. Mills, president; W. J. Struewing, superintendent.

The Springfield Machine Tool Co. 1W 7. 14 in. x 6 ft. quick change geared head engine lathe; belted M.D. in leg, with taper attachment, Timken bearings, draw-in Collet attachment with Collets; 18 in x 8 ft. quick change geared head engine lathe, belted M.D. in leg, taper attachment, oil pan, Timken bearings and turret tool post; machine for removing gear teeth from fly wheels.

Edward S. Montanus, secretary; Paul A. Montanus, vice-president.

The Standard Electrical Tool Co. 4C 4. Portable electric drills; electric driven grinders; electric driven buffers; electric driven polishing machines.

G. H. Feltes, president.

Standard Steel Specialty Co. 5C 5. Machine keys; Woodruff keys; machine rack; taper pins; elevator guides; special milled sections.

E. J. Wagner, president; J. B. Jamison, secretary and sales manager.

The Standard Tool Company. 5W 2. Twist drills; reamers; taps; milling cutters; drill chucks.

H. C. McKean, gen. mgr.; W. P. Ross, mgr. of sales; R. R. Higgins, asst. sales mgr.; H. R. Hanson, sales rep.; C. C. Buck, metallurgist; T. D. Bascom, master mechanic; J. G. Green, tool expert.

Stark Tool Co. 1W 23. Stark Precision lathes; bench milling machines; motor drive unit.

Frederick T. Potter, factory mgr.; E. Clifford Potter, president.

The L. S. Starrett Co. 5W 8. Mechanical tools; gauges; micrometers; indicators; rules; squares; hack saws; steel tapes.

H. E. Masters, advtg. mgr.; W. D. Starrett, and J. G. Sisson, engineering dept.; D. Findlay, sales mgr.; A. H. Starrett, m.m.; O. J. Rogers, Ohio representative.

Stockbridge Machine Co. 1W 13. Barrett centrifugal oil extractor, model 1200; centrifugal dryer, model 502; centrifugal washer, model 251; Stockbridge heavy duty back-geared shaper with patented two-piece crank.

Leon J. Barrett, R. A. Johnson, H. G. Kilbourne, C. B. Laing, N. F. Holter.

D. A. Stuart Oil Co. 4W 5. Stuart's "Thread-Kut" alloy steel cutting oil; "Super-Kool" light colored heavy sulpher base oil; "Codol" liquid grinding compound; "Kleen-Kut" soluble oil; "Drawsol" deep drawing compound; No. 34 soluble quenching oil.

T. B. Langdon, W. H. Oldacre, Chicago; C. H. Baker, Cleveland; G. A. Dudley, Buffalo; J. W. Beaver, New Haven; C. I. Grierson, Toronto; A. S. Hull, Philadelphia.

Sundstrand Machine Tool Co. 1A 7. No. 40 Rigidmil; No. 33 Rigidmil; No. 22 Rigidmil; No. 3 Rigidmil; 8 in. brake drum lathe; 15 in. automatic stub lathe; 4 in. x 24 in. centering machine.

Hugo L. Olson, president & gen. mgr.; G. D. Sundstrand, chief engineer; D. B. Burleigh, gen. sales manager; L. A. Dumser, ass't chief engineer; Gust H. Ekstrom, works mgr.; G. A. Markuson, advtg. mgr.; T. B. Buell, A. E. Gutzwiller, sales representatives.

Sun Oil Company. 4A 4. Emulsifying and straight cutting oils; machines demonstrating cutting oils; machined parts.

R. S. Drysdale, C. K. Hague, C. B. Harding.

Superior Machine Tool Co. 3W 18. Superior type M-10 in. bench drill, motor driven; type B-20 in. floor drill, motor driven; type HD-25 in. floor drill, motor driven.

E. A. Simmons, president; C. E. Hansell, secretary, O. L. Ham, sales engineer; M. L. Hensley, advtg. manager.

Swift Welder Co. 2D 8. 36 in. Super-Dreadnaught shaper; 24 in. dreadnaught shaper; Swift No. 35 flue welder; No. 6 combination copper and steel welder; No. 12 automatic welder; No. 16 projection welder.

Charles C. Swift, Cecil J. Davis, F. E. Taylor, H. A. Woofter.

—T—

The Taft-Peirce Manufacturing Co. 3W 11. Adjustable reamers; angle irons; box parallels; boring tool holders; contract service; plug, ring, snap and thread gages; parallels; production and inspection tools; sine bars; Superpower magnetic chucks; surface plates; thread milling machine; toolmakers' knees; V blocks.

F. S. Blackall, Jr., P. V. Miller, W. E. Rogers, E. D. Wolf.

The Taylor & Fenn Company. 2A 3a. Two spindle horizontal spline milling machine; high speed vertical milling machine; two spindle drilling machine with built-in motors on the head; four spindle drilling machine; No. 0 spring press; No. 00 spring press; No. 12 motor driven spring press.

George S. DeLany, Nels Carlson.

The Thompson Grinder Co. 2W 13. Thompson 12 in. x 36 in. self-contained motor driven Universal grinding machine.

C. Baldenhofer, president and general mgr.; H. J. Warrick, vice-president and secretary; W. G. Baldenhofer, engineer; J. A. Martin, superintendent.

The Timken Roller Bearing Co. 4W 2. Timken tapered roller bearings.

L. M. Klinedinst, W. B. Moore, R. P. Kelley, J. W. Weir, G. D. Thewlis, S. M. Weckstein.

Titeflex Metal Hose Co. 5B 7. "Titeflex" all-metal flexible tubing, for the carrying of lubricants and cutting compounds.

Elbert E. Husted, sales mgr.; R. R. Hazel, sales engineer.

The Torrington Co. 1W 1. Three sizes of Dayton-Torrington swaging machines; Torrington ball bearings.

F. T. Case, G. H. Schneider, M. W. Maine.

Tuthill Pump Co. 5C 3. No. 1R reversing pump for handling coolant; No. 6M motor driven pump for handling coolant; No. 2M motor driven pump for handling coolant; OB motor driven pump for lubricating or hydraulic serv-

ice; No. 6C tight and loose pulley drive pump for handling quenching oil; No. 2MS pump unmounted; No. 2CS pump unmounted; Tuthill high-pressure pump for hydraulic service, unmounted.

G. B. Tuthill, H. E. Kempton, W. C. Croft, H. C. Osborne.

Twin Disc Clutch Co. 4W 15. Dry plate type clutches; multiple disc clutches designed to operate in bath of oil.

P. H. Balten, president; W. C. Gewalt, vice-president; G. M. Guilbert, secretary & sales mgr.; R. H. Smith, Cleveland rep.; W. L. Dixon, New York rep.; G. L. Williams, sales engineer.

—U—

Union Mfg. Co. 5C 8. Lathe chucks; boring mill chucks; planer chucks; drill chucks; face plate jaws; boring mill jaws; chain hoists.

C. S. Neumann, president; F. J. Wachter, vice-president and sales mgr.; A. E. Church, mech. engineer; E. I. Stevens, sales department.

The United States Electrical Tool Co. 1A 15. Electric directly connected grinders and buffers; electric lathe grinders; portable grinders; electric drills.

G. M. Lawrence, sales mgr.; G. E. Smith, treasurer; J. A. Smith, president; H. O. Coe, Cleveland district mgr.; J. C. Goodman, Pittsburgh district mgr.; R. H. Clore, F. Franklin, W. B. DaSilva, R. N. Brayer, H. B. Griner, H. N. Kelsey and J. R. Miller, sales representatives.

Universal Boring Machine Co. 2B 4. No. 40 Triway Universal horizontal boring machine: Hanson measuring attachment.

John C. Spence, works mgr.; Leon F. Marsh, mech. engr.; Warren B. Robbins and Walter H. Chapman, sales representatives.

—V—

The Van Dorn Electric Tool Co. 4B 3. Portable electric drills; screw drivers; tappers; nut setters; reamers; portable and stationary polishers; grinders; buffers; drilling and grinding stands, bench type; portable electric hammers; portable automatic heat control glue heaters; electric valve refacers; valve reseating cutters; portable disc sanders; portable electric socket wrench; high frequency portable high production tools.

F. Schneider, president; F. H. Zulauf, vice-president and gen. mgr.; R. W. Proctor, sales mgr.; E. W. Waechter, asst. sales mgr.; E. L. Connell, chief engineer; S. S. Waters; L. L. Charnicky; F. R. DuGuay.

Van Norman Machine Tool Company. 1A 14. No. 10 Van Norman Duplex miller, motor driven, with worm index centers and high speed spindle; No. 3 Duplex miller, motor driven, with 10 in. full Universal centers, sub-head, and Universal slotting attachment; No. 25 oscillating grinder, motor-driven, with full ball bearing work heads, special chucking device and water equipment.

C. E. Van Norman, president; F. D. Van Norman, vice-president; J. Y. Scott, gen. sales mgr.; L. H. Campbell, vice-president; William M. Edes, Detroit sales mgr.; Roger Pyne, gen. service mgr.; H. Bordeaux, chief engineer.

—W—

O. S. Walker Co., Inc. 2W 8a. Single stroke surface grinding machine; magnetic chucks.

George F. Shirley; Elzcar Laporte, operator; Clayton O. Smith; treasurer; Howard E. Tracy, engineer.

The Warner & Swasey Company. 1A 1. No. 5-A and 1-A Universal hollow hexagon turret lathes in operation on actual work; No. 5 and No. 4 Universal all geared head turret lathes in operation on actual work.

P. E. Bliss, president; A. C. Cook, vice-president; C. J. Stilwell, vice-president and gen. sales mgr.; E. R. Gardner, mgr. New York territory; H. R. Ward, mgr. Boston territory; L. K. Berry, mgr. Philadelphia territory; A. H. Keetch, mgr. Buffalo territory; W. K. Bailey, mgr. Cleveland territory; W. L. Loegler, mgr. Dayton territory; C. S. Stilwell, mgr. Detroit territory; G. Kochenderfer, mgr. Chicago territory; F. J. Pelich, mgr. Milwaukee territory; L. M. Cole, mgr. Texas territory; L. R. Hawkins, mgr. Pacific Coast territory.

Westinghouse Electric & Mfg. Co. 5B 1. Motor starters; motors; gears; belt drive (cog belt); controllers for motors; electric welders.

Bernard Lester, C. B. Stainback, H. L. Wilson, P. McShane, W. W. Reddie, J. M. Wetzig.

The Whitney Mfg. Company. 2B 6. Chains and sprockets for power transmission.

R. A. Glass, R. A. Follensby and S. C. Smith, sales engineers.

Whitney Metal Tool Co. 2W 16. Ball bearing metal punches; lever type metal punches; deep throat metal punches; angle iron machinery; notcher; benders; shears; awls; hammers; rivet sets.

John Jensen, secretary and mgr.; Gus Jensen, representative.

Williams Tool Corporation. 3W 3. 6 in. Williams "Rapiduction" pipe threading machine; 2 in. double spindle bolt threader; 2 in. portable pipe threading machine; 4 in. "Wilco" pipe threading machine.

E. P. Poole, vice-president; D. Moreinis, C. Tankred and H. Van Osten, district sales managers.

Wisconsin Electric Co. 5C 4. No. 5 grinder with attachments A, B and C; No. 3 grinder, Tl. shop utility tool; No. 2-AG grinder drills; No. 1 grinder motors.

C. A. Pope, advtg. mgr.; W. B. O'Neill, sales rep.; W. E. Pomeroy, sales.

—Y—

Yale & Towne Mfg. Co. 4C 5. Yale chain blocks, trolleys, cranes, electric hoists, motor driven trolleys, electrical industrial trucks, hardware, locks.

J. C. Morgan, E. H. Fairchild, H. S. Pierson, R. H. Irwin, F. A. Dewey, M. G. Peck, R. L. Higgins, C. O. Hedner.

The *American Machinist* at the Exposition

FOR 52 YEARS the *American Machinist* has been the friend, counselor and clearing house of information for the industry.

THROUGH ITS EXHIBIT at the Exposition it will continue that function in a new way. If you want to know where any exhibitor's booth is, or anything else about the Exposition, ask the *American Machinist.*

BOOTH 1E2—just as you enter the Exposition.

Noteworthy Progress in MACHINE TOOL

THE Second National Machine Tool Builders' Exposition, to be held in Cleveland, September 30 to October 4, 1929, marks another forward step in the industrial history of the United States. The exposition of two years ago, the initial exhibition of the Association, was unusually successful. While the growth and prosperity of the machine tool industry since that period is based largely on the generally prosperous condition of all of the many branches of industry that it serves, the effect of the first exposition in contributing to that prosperity, by demonstrating and widening the uses of machine tools, mechanical equipment and industrial supplies, must not be overlooked.

With the experience of the first exposition as a guide, the second has been organized on even more effective lines. In 1927 there were 180 exhibitors. This year there are 244 and 65 more were unable to secure space. In the special exposition issue of 1927 the *American Machinist* featured 70 items describing new machines and equipment displayed at the show. The present issue contains 102 such descriptive items covering 110 different machines or products exhibited. At least 25 additional new machines or tools will be on display, on which data and illustrations were unavailable in advance, because the products themselves could not be completed until just a few days before the exposition. Approximately 433 new machines and mechanical devices have been described in the pages of the *American Machinist* during 1929, up to the present issue. When the 110 new products are added, making a total of 543 items announced so far this year, some idea may be gained of the vast industrial development at present under way in the metal-working field. At the show 400 carloads of machinery will be displayed.

One of the outstanding factors in the present exposition is the strong demand evidenced for "high production" machines. So pronounced has this demand become that many manufacturers of equipment have incorporated this term into the names designating their new equipment. This element of increased production from equipment has been responsible for the development of many new tools, for the radical improvement of many others, and for the greatly increased weight given to the factor of obsolescence of equipment on the part of practically all users of machines and tools. Competition among these users in selling the products of their own plants has induced them to demand increasingly higher output from the manufacturing equipment they buy from machine tool builders, in order to reduce production costs. The machine tool industry has responded promptly and effectively to this demand and the exposition will be a revelation of the progress made along such lines during the past year.

The substitution of automatic operation for hand operation on a number of the machines developed is another prominent factor featured in the equipment placed on exhibition. Wherever feasible this improvement has been made. Such developments have demanded no little skill and ingenuity on the part of the machine designer and builder. Radical changes were required in most cases. The resulting equipment requires more care in set-up, more certain means of lubrication, and may involve a higher maintenance charge on account of the refinement of parts introduced. On the other hand, sturdiness has been added in most cases in developing or redesigning such types of equipment. Adjustments in its use, of course, must be made by skilled mechanics who are experienced in special machines, rather than by the ordinary machine operator. But to offset any increased initial cost and any added operating or maintenance expense, a vast increase in output has been brought about, making the unit cost of products manufactured only a fraction of what it was when former types of equipment were employed.

Mechanical features of operation are well typified by a feeding device developed and applied to one of the well-known lines of automatics. No operator is now required for this machine. A long runway holds a store of the work, and the two-arm-work-feeding mechanism picks up one part at a time and brings it into position between two tool-holding slides, one of which carries turning tools and the other grooving, facing and forming tools, where it is held between centers. The work is driven by the mechanism. When the machining has been completed a second arm automatically moves up and discharges the piece on a runway carrying it away from the machine, while the first arm moves in a new part for machining. The machine continues to operate in this way until stopped by the push-button control.

THE present tendency in machine design is rather away from the single-purpose machine. For high production and very special work the single-purpose tool, of course, will always find a market. But its limitations when sudden and radical changes in the design of products come about, are causing machine tool builders to devote much less attention to this type of equipment, and more attention to the provision of special fixtures adapting standard tools to definite production jobs, and to the design of unit type equipment to be built up into various combinations suited to the requirements of different jobs. This tendency is most decided and undoubtedly will continue to be a major factor in machine design for a long time to come.

Even in cases where machines have been developed for special purposes there have been introduced certain features which widen the uses of the equipment. For instance, a certain type of grinder designed for special railroad equipment work on a production basis, has been adapted so that the machine can be used for tool grinding or production grinding on other types of work.

There is a definite tendency toward a more extensive use of hydraulic mechanisms on numerous types of machine tools. These mechanisms are used for the feeding of work, and a large number of machines at the Cleveland show will feature this development. Thirty years ago hydraulic feeds were experimentally tried on flat turret lathes. About fifteen years ago drilling machine manufacturers did considerable experimenting with such mechanisms. Out of all this experience the hydraulic feed has now emerged as a definite factor in machine design. It has the advantages of being compact, positive,

powerful, reliable, and steady and smooth in action. In many cases it offers a much simpler design than mechanical devices. To a certain extent, also, it is often much less subject to failures and needs considerably less adjustment and repairs than mechanical elements. Of course, it has by no means widely displaced mechanical mechanisms and may never do so. At the show, new applications of hydraulic feed to equipment such as lathes, grinders, smaller sizes of milling machines, multiple-spindle drills, honing machines, and broaching machines, will be demonstrated.

Further improvements in indexing have been made on machine tools placed on exhibition this year. One outstanding development is the application of the double Geneva motion on a work-rotating chucking machine with an unusually large turret that is indexed in four positions 90 deg. apart. This machine also represents several other outstanding developments in machine design.

INCREASING attention to lubrication is decidedly evidenced by the equipment developed during the past year, much of which will be placed on exhibition at the show. No definite tendency toward any one type of lubrication is to be discovered. Some manufacturers have adopted central, forced-feed systems for their equipment. Others prefer gravity feed from central reservoirs. Still others retain the oil-cups for individual bearings. Combinations of systems are also of frequent occurrence. For instance, the chucking machine above mentioned employs a central lubricating system for the main bearings of the machine, but a gravity-feed reservoir for the heavy turret, to avoid the use of slip joints which would be required if the main system were utilized for turret lubrication. One manufacturer is introducing a forced-feed lubricating system operated periodically under the control of an electric timing clock. Oil filters are also finding more extensive application. In no case is lubrication neglected as a factor in machine operation and maintenance.

The influence that tungsten carbide cutting alloys are due to play in machine design is already felt. After many experiments, makers of certain types of equipment are claiming that, in the main, their machines are sufficiently sturdy, without extensive redesign, to withstand the heavy strain imposed by the high rate of speed at which they must be operated to gain the maximum advantage from the new alloys. Other manufacturers have designed new equipment to make use of the higher speeds and feeds possible with tungsten carbide tools. In both the new and the improved machines the power required has been reduced, and the heat otherwise generated has been avoided, by the use of roller or ball bearings. Every manufacturer of equipment is on the alert to gain the benefits to be secured from the application of the high speed cutting alloys and exhibits of these metals, tools made from them, and machines developed to utilize such tools, are certain to attract considerable attention to the show.

Small tools, instruments, and industrial materials and supplies will form an interesting part of the exposition to a large number of visitors. One of the exhibits will feature a device for measuring and recording the pressure on cutting tools, and the power required to take cuts on different metals, and at different points in the same piece of metal. In electrically-operated tools, many of which have come on the market in recent months the high-cycle types occupy a position of prominence. The 180-cycle tool has higher torque and higher sustained operating speeds than the 60-cycle tool, and represents a definite tendency in design.

There is a marked tendency among manufacturers toward a differentiation of equipment of similar classes. This tendency may have resulted from contact with the automotive industry, for which machine tool builders have furnished a vast amount of equipment. But, as motor cars are distinguished by distinctive features of body design, by differences in construction, and by varying combinations of characteristics so that the purchaser has a wide choice, depending on what best serves his demands, so the purchaser of machine equipment is offered distinctive combinations of uses and applications in the many types of machines available for certain broad classes of work. It is no longer a case of "a machine" for the job, but *the* machine most suitable for the job. Machine tool buying has therefore become a more important function in every manufacturing plant requiring machine equipment.

Many other factors have become of increasing importance in machine design during the past year, and characterize practically all of the equipment placed on exhibition at the show. Among those factors which have received special consideration are: A higher degree of accuracy in the parts comprising machine tools and equipment, provisions for a higher degree of accuracy in the products turned out, ease and convenience of operation, reliability of service, compactness of design, decrease of floor space occupied, simplicity of drive, reduction of power consumption through the liberal use of ball and roller bearings, higher grades of steel and alloys for journals, spindles, gears, and other operating parts of machines, convenience of inspection and cleaning, provisions for the removal of chips, facilites for mechanical handling, and the features of higher production, greater automaticity and adequate lubrication, which have been discussed above.

THE keynote of the exposition is the growth of mechanization in American industry. Many of the machines exhibited perform a series of highly complex operations, turning out complicated parts of a high degree of accuracy with a rapidity far beyond the possibilities of former types utilizing hand operation. Several of the machines seem almost human in their action. In fact, they perform operations absolutely impossible without most ingenious mechanisms. An unusually large number of new machines of considerable size will be on display. Wherever possible machine tools on exhibition will be shown in operation on actual production jobs. The considerable economies in production and the large reductions in manufacturing costs that these machines have made possible will thereby be most effectively demonstrated.

SHOP EQUIPMENT NEWS

One hundred and ten items of new equipment, which will be on display at the Cleveland Exposition, are here described and illustrated for the benefit of those who will and those who will not be able to attend

Goss & DeLeeuw No. 6 Work-Rotating Chucking Machine

THE No. 6 Goss & DeLeeuw machine just being placed on the market by the Goss & DeLeeuw Machine Company, New Britain, Conn., is a distinct departure in chucking machine design in which the four work spindles are supported in a large, horizontal turret, 90 deg. apart, and present the work to three sets of tools for simultaneous operation. The work is loaded in, and removed from, the chuck at the front of the machine, this chuck being stopped and started by its lever on top of the turret. This lever controls the driving gear on the work spindle, remaining idle in the neutral position. Raising the lever engages a cone friction that starts the work spindle. Pulling the lever down then engages a jaw clutch, without shock, and gives a positive drive.

Power for driving the work spindles is secured from the main motor at the left in Fig. 1, and at the right in Fig. 2. As shown, this is a 15 hp. motor, but as the driving mechanism is designed to transmit 25 hp. safely, a large motor can be used when required. A silent chain transmits the power from the motor to a cross shaft from which bevel gears and a longitudinal shaft drive a vertical shaft under the center of the turret.

Power is taken from this shaft for each of the work spindles from a spur gear on the vertical shaft, four substantial spur and bevel gear combinations carrying ample power to the work spindles. The bevel gears drive a large spur gear that is in constant mesh with the main gear on the work spindle. These gears drive the spindles through splines that are integral with them. The splines permit the wide-faced final gear to be moved forward or back by the clutch lever on top so as to engage either the friction clutch for starting the spindle or the positive jaw clutch for driving the work in the cut. All four work spindles revolve simultaneously and at the same speed. A 2 to 1 back gear gives a fast or slow spindle speed for each combination of change, or "pick-off" gears that are easily accessible under the cover at the extreme right of the bed in Fig. 2.

Spindle speeds have a normal range of from 16 to 525 r.p.m. The ease with which gears can be changed makes it possible to secure the exact speed best adapted for any particular job, and each combination has its high and low range of 2 to 1.

A second motor, not shown in Fig. 1 but seen at the extreme left in Fig. 2, furnishes power for the various feeds and for indexing the turret. This is a 5-hp. motor on all machines. The third motor is on the rear tool slide and is for special work where drilling or high-speed boring is part of the operation at that station. This combination permits the work spindles to revolve at the proper speed for turning and facing, while the boring or drilling spindle can be speeded as high as necessary by driving it in the opposite direction by an independent motor. This unit can be placed in any one of the three tool heads or on all three heads should the work demand it. All three of these motors are connected to the same control box, and are stopped and started simultaneously by push button control. Push buttons are provided below each tool head so that the machine can be started, stopped, or "jogged" from either point. This feature is particularly convenient in setting tools on a new job as the operator can jog the machine without moving from his position at any tool head. The tool head motor can be of any size needed for the work in hand.

For threading, either internal or external, the regular Goss &

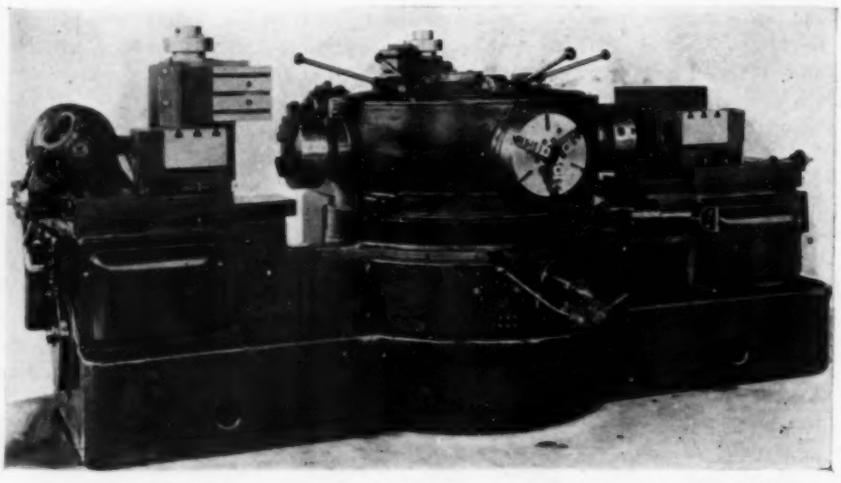


Fig. 1—General view of No. 6 Goss & DeLeeuw chucking machine with four work spindles and three toolslides

DeLeeuw thread-cutting head with reversing motor can be mounted on either of the toolslides. This head uses a lead screw and where both inside and outside threads have the same lead they can be cut at the same time.

A fourth motor, not shown, drives the coolant pump. This motor is independent of the other three so that coolant can be shut off when setting tools or for any other reason. The base holds 2 barrels of coolant so that the returned liquid has ample opportunity to cool before it is again pumped to the work.

With the work spindles mounted in the large turret shown, which is approximately 4 ft. in diameter, there is ample room for a large spindle and any type of bearing desired. The machine illustrated has double ball bearings in front and single floating ball bearings at the rear, both being of the combined radial-thrust type. These bearings are pre-loaded to 4,000 lb. Roller or plain bearings can be used as preferred by the customer. The spindles are of forged, alloy steel and are about $4\frac{3}{4}$ in. in diameter when using ball bearings, and $5\frac{1}{4}$ in. when using plain bearings. The chucks shown are nominally 12 in. in diameter but chucks up to 20 in. can be used.

Unusual Indexing Arrangement

Indexing the heavy turret 90 deg. is done by an unusual adaptation of the Geneva motion. It requires considerable power to start a turret as large as this and the movement is continued through a large arc. The indexing is simply and efficiently secured by using two rollers on the face of the Geneva wheel, these rollers engaging a suitable slot in the bottom of the turret. Each roller moves the turret 45 deg., the second roller picking it up just as the first roller leaves the slot. While this does not give a strictly continuous motion, it accomplishes the desired result quietly and accurately. The turret is located in its indexed position by a heavy wedge bolt, tapered on one side. This bolt is controlled by a compressed air cylinder with differential pistons that give a pressure of 2,500 lb. to hold the bolt in place. A cam on the outer edge of the Geneva wheel controls the air valve shown under the right hand turret in Fig. 1, this valve admitting air after the turret is indexed and holding it until the indexing lever in front of the machine is raised. The locking is positive, nearly silent and without jar in spite of the pressure used. After the indexing is completed a small drum cam locks the turret by closing a large diameter clamping ring on a bevel flange at the bottom.

All feed movements are secured direct from solid barrel track cams mounted beneath the toolslides. The toolslides are large, have either longitudinal or vertical motion, or both, and can be made in almost any combination desired. The standard plain head, as shown at the right of Fig. 1, carries a heavy tool block with T-slots on its upper face only. These are for clamping turning or facing tools for ordinary work, or for boring tools when the bored diameter is large enough to require it. The block is also bored to take a large boring bar of any kind, while the front or side faces can be drilled and tapped for bolting special tool heads in place if necessary.

The vertical toolslides, shown in Fig. 2, are also controlled by a solid barrel track cam, this being directly behind the slide. This toolblock has T-slots for facing tools or for turning a large diameter flange. All feeds can be stopped and started by the small lever at the right in the group of three shown at the front of the machine. The shaft at the top of the group is for turning the machine over by hand should it be desirable at any time. The lever, as before stated, trips the indexing mechanism but can only index the turret when all the toolslides are withdrawn from the work.

All revolving parts, except those in the turret itself, are oiled from a central reservoir at the back by the Madison-Kipp system with a lead to each bearing. The pump is chain driven from the motor that drives the feeding mechanism. The work spindles and their driving mechanism inside the turret are oiled from a central reservoir at the top of the turret, all indexing with the turret.

By this method all complicated piping with swing joints is avoided, thus saving in the cost of maintenance. Each chuck has an Alemite connection for lubricating the scroll and other moving parts of the chuck itself. This is a refinement that is typical of the advances made in the design of machines where delays are costly and continuous operation is worth much more than the slight additional cost.

The front work spindle is stopped by raising the lever to its neutral position. After loading the machine, the operator raises the lever to start the spindle by the cone friction, then throws in the heavy jaw clutch by pulling the lever down. Any type of chuck can be used, 2-, 3-, or 4-jawed, and with special jaws, according to the work to be done. The machine weighs about 13 tons.

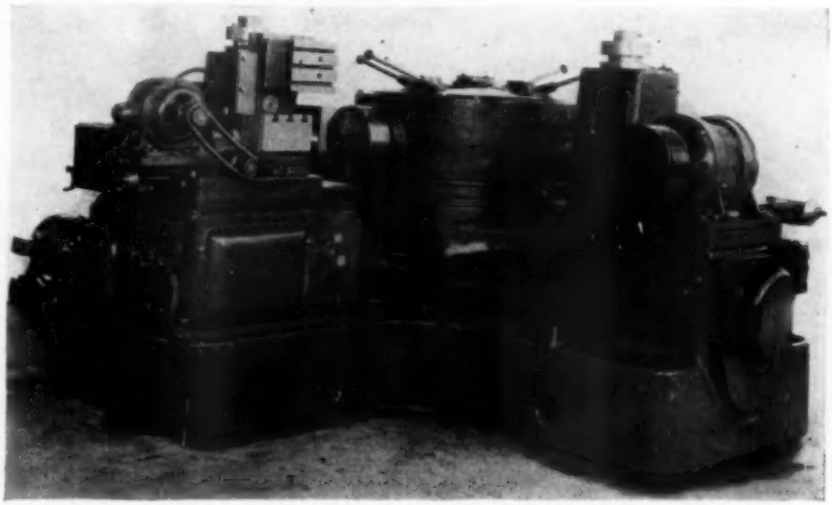
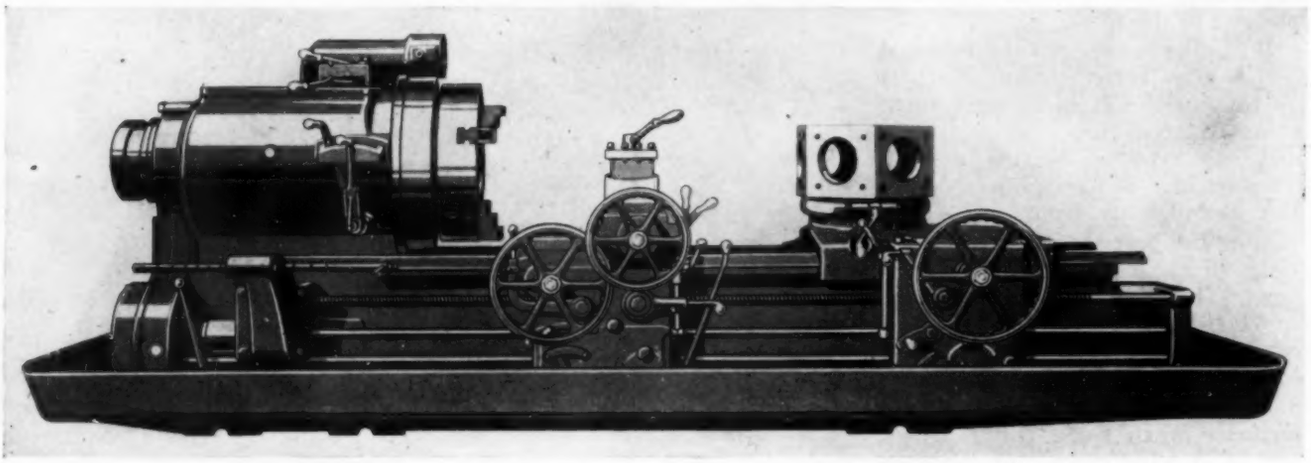


Fig. 2—Rear view showing the driving motor, the rear toolslide, and the general contour of the machine

Warner & Swasey No. 5-A Universal Turret Lathe

THE Warner & Swasey Company, Cleveland, Ohio, has announced a No. 5-A Universal turret lathe embodying several new features. Power, sturdiness, ease of operation and lubrication are the four elements of design which have been given major consideration in this turret lathe.



Warner & Swasey No. 5-A Universal Turret Lathe

This machine, the largest ever built by this company, has a capacity through the spindle and 30-in. chuck for round bars up to 10 in. in diameter and a maximum turning length of 62 in. For chucking work, the maximum swing over the covers for the ways is 32 in., and over the cross-slide 26¼ in. Twelve speeds are available in the all-geared head and twelve feeds are obtained independently in the hexagon turret and cross-slide aprons.

It differs from other "A" type Warner & Swasey machines, described in previous issues of the *American Machinist*, in a unique type of head construction from which the front gear shafts and all revolving gears on the spindle have been eliminated, the number of gears necessary to obtain the twelve speed changes has been reduced, and the gear shafts have been made short and stubby.

Power is applied through a single pulley mounted on a high-speed drive shaft located at the lower rear end of the head. From this point the drive is carried upwards to the spindle through a series of sliding gears and splined shafts. The spindle and all head shafts are mounted on Timken roller bearings. Starting, stopping, and reversing is accomplished through multiple-disk clutches and is controlled by interlocking levers, one at the head and the other at the right-hand side of the cross-slide apron. This feature makes it unnecessary for the operator to leave his position when working with tools on the side carriage or hexagon turret.

To insure proper lubrication of the head, oil is drawn from a reservoir in the base by a pump through a Purolator, to a large trough in the rear top of the head. The overflow from the trough cascades over the gear train. In addition, copper tubes lead oil from this trough to the spindle and gear shaft bearings. The pump has a capacity of 1½ gal. per minute.

Several motor mountings have been designed to meet the demand for various types of direct motor drive. The head and bed, made of a nickel semi-steel, are cast in one piece. In addition, the head walls, which are of box construction, are brought well above the center line of the spindle. The Warner & Swasey patented way covers completely inclose and protect the bed ways from chips and dirt.

The hexagon turret is of the familiar heavy, hollow type with broad faces to which the tools and holders are bolted from the inside. A power rapid traverse has been provided for moving the hexagon turret to and from its working position. It can be arrested at any point, making possible the indexing of the turret anywhere along the bed. A separate rapid-traverse shaft extends along the front of the bed, and is provided with a safety multiple-disk clutch at the head end to prevent damage in the event the turret saddle should collide with the cross-slide. Likewise, a mechanical interlock eliminates the possibility of engaging the power-feed and the rapid-traverse at the same time.

Twelve feed changes are contained independently in the hexagon turret saddle apron and are obtained through hardened alloy steel sliding gears. Tapered roller and ball bearings are used throughout.

The turret feeds are automatically disengaged by adjustable stop-dogs on a roll located between the V's. The stop-dogs can be quickly and accurately set, which is an important feature on small lot work. By swinging the stop, an entire set-up of tools can be moved toward or away from the spindle without disturbing the stop-dogs on the roll and permitting an occasional job to be put into the machine without changing the settings.

A stationary lead-screw also extends along the front of the bed and passes through both aprons. All feeding and rapid-traverse motion as well as threading motion is carried to the hexagon turret saddle and cross-slide by a long nut in each apron, rotating

on ball bearings on this lead-screw. A change-gear box for threading is located at the head end of the feed-shaft.

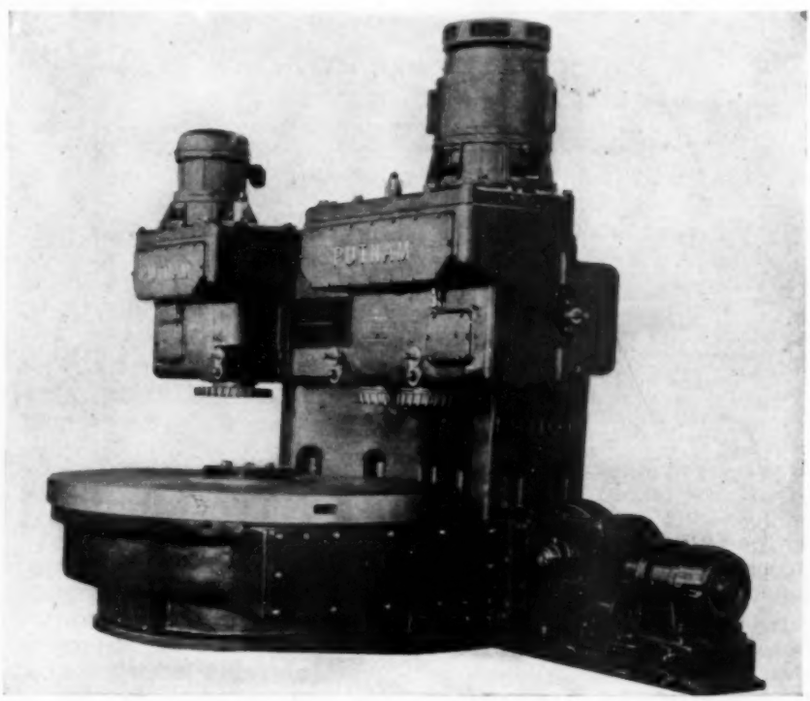
A full-swing side carriage is mounted on the front V, a construction which permits keeping the distance from the center of the spindle to the bed ways to a minimum. The top inner bearing surface of the side carriage has a step, the shoulder of which is gibbed to the corresponding shoulder of the front V of the bed. In addition, this carriage is anchored to a third rail near the bottom of the bed on the front side. Four or more forged cutters can be held in the quick-indexing square turret at one time.

Twelve power longitudinal and cross-feeds are contained in the side carriage apron and these may be operated either forward or reverse. As in the hexagon turret saddle apron, tapered roller and ball bearings are used throughout. Power rapid-traverse is provided for both the longitudinal and cross-motions of the side carriage. A safety mechanism prevents engaging the feed and rapid traverse at the same time.

Both aprons are completely fitted with Alemite-Zerk connections assuring high-pressure lubrication at all points. A large cast iron base acts as a sump for the coolant and provides a rigid foundation for the bed. The cutting lubricant is delivered by a pump at the rate of approximately 14 gal. per minute.

Putnam 72-Inch Rotary, Continuous Milling Machine

A 72-IN. rotary, continuous milling machine designed for production milling in automobile plants or other industrial plants, having large numbers of duplicate parts to be machined, is being introduced by the Putnam Machine Works, Div. of Manning, Maxwell & Moore, Inc., Fitchburg, Mass. The machine represents an application of the Putnam unit milling head to a rotary miller. It has a two-spindle head for roughing and a single spindle head for finishing, both mounted on a rail and so arranged that the horizontal distance from the spindles to the center of the rotary table may be varied to suit the requirements of the work.



Putnam 72-Inch Rotary, Continuous Milling Machine

Simple manufacturing heads, which may be adjusted along the rail by means of hand-operated screws, are used in this machine. There are also means for adjusting the position of the quill to compensate for the wear of the cutters. Each head is equipped with a constant-speed motor, giving a single spindle speed, which may be varied by change gears to meet production requirements. The rail, upon which the unit heads are mounted, and the column which supports it, is an integral casting, which is made exceptionally wide at the base.

The rotary table has angular bearings and two flat bearings, and is driven by a wormwheel located inside of the outer flat bearing. This wormwheel is cut so that the pressure is always down on the bearings. Table feed is driven by a separate motor, and may be varied to meet requirements by means of change gears. The motor controls are so arranged that the failure of either spindle motor will stop the table feed automatically.

Each unit milling head is driven by an individual motor mounted upon it, and is made either with a single spindle speed with pick-off gears for limited variations, as in this case, or with a multiplicity of speeds to meet the requirements of a more general service machine. When required it may be furnished with a multiplicity of feeds, both for moving the quill in and out of the head, and for feeding the head along the rail. To reduce the power loss between the motor and the cutter, the motor is located on the head itself, and roller bearings and heat-treated helical gears are used in construction. The approximate net weight of this machine is 25,000 pounds.

Gleason Spiral-Gear-Cutter Angle-Testing Device

This testing device, introduced by the Gleason Works, Rochester, N. Y., is used as a comparator to insure that the blades in the circular cutters used on Gleason spiral bevel and hypoid gear cutting machines are so mounted as to have absolutely identical cutting pressure angles. The blades are now being sold separately from the cutter heads and it is essential that they

Gleason Spiral-Gear-Cutter Angle-Testing Device

be carefully checked after being assembled in the cutter head. A slight variation in the angle of blades will cause flats on the teeth being cut. Any corrective work necessary to locate the blade accurately for angle can be done on this new fixture without removing the cutter.

The device includes an indicator reading in 0.0001 in., a cutter head carrier against which the cutter is held by spring pressure, and a gibbed dove-tail slide on which the carrier is angularly adjustable, and which is slidable on the base of the fixture so that the blades in the cutter can be moved back and forth under the indicator finger.

The cutter to be checked is placed on the carrier, which is then adjusted so that the indicator shows zero as the slide is moved to carry one of the blades under the indicator for its full working depth. The next blade is then rotated into position under the indicator and moved back and forth. If correct, the indicator will read zero for the full working depth of this blade. If it does not, the cutter can be locked against rotation and the blade readjusted. A reading is taken on each blade and any adjustment necessary made to insure that all the blades will cut alike.

The indicator holder is vertically and horizontally adjustable on the base so it can be used for checking both inside and outside blades. The cutter head carrier has a wide range of angular adjustment for covering the full range of pressure angles. The tester is built in two sizes, one for 9-in. and the other for 12-in. cutters.

Lucas Model 41 Horizontal Boring Machine and Square Swivel Tables

TO ITS line of horizontal boring machines, The Lucas Machine Tool Co., Cleveland, Ohio, has added a model known as the No. 41 Lucas precision horizontal boring, drilling and milling machine. This machine has a 3-in. spindle and, as compared to the No. 31, which it supersedes, is heavier, has a wider bed with leveling screws, which greatly facilitates setup and accurate alignment, a longer saddle, 50 per cent more speed changes, automatic lubrication, and a number of other improvements.

With this machine the "40 Series," comprising the No. 43, having a 5-in. spindle, and No. 42 having a 4-in. spindle, is completed. The larger machines have similar features, and, in addition, some not considered necessary in the smaller unit.

In the Model 41, the saddle is provided with automatic equalizing clamps operated from the front and simultaneously binding front and rear caps under the ledges of the bed ways, thus overcoming any tendency to tilt when the table, with heavy work, is in its extreme forward or rear positions. There are also more effective and convenient means of clamping the table and spindle head. A long narrow guide with taper gib, for the table cross-travel on the saddle, tends to minimize any cramping tendency. Not only are higher and lower speeds possible with the greater number of speeds in the transmission, but the increments are smaller. Automatic lubrication is provided by means of a pump in the driving-gear box and by oil rings on the spindle. Greater power, more convenient controls, and added safety features, including an increased number of limit trips, are among other new items in the design.

A type of square swiveling table, made in 26-in. and 37-in. sizes, also is offered for use on the "40-Series" machines. It is designed to afford greater clamping surface and better support of work at the edges, than the regular circular swivel table. The square table is mounted on a baseplate and is a self-contained unit, interchangeable on the different machines. It is graduated in half-degrees and is provided with a lockbolt for each of the four positions 90 deg. apart. Swiveling is facilitated by an elevat-

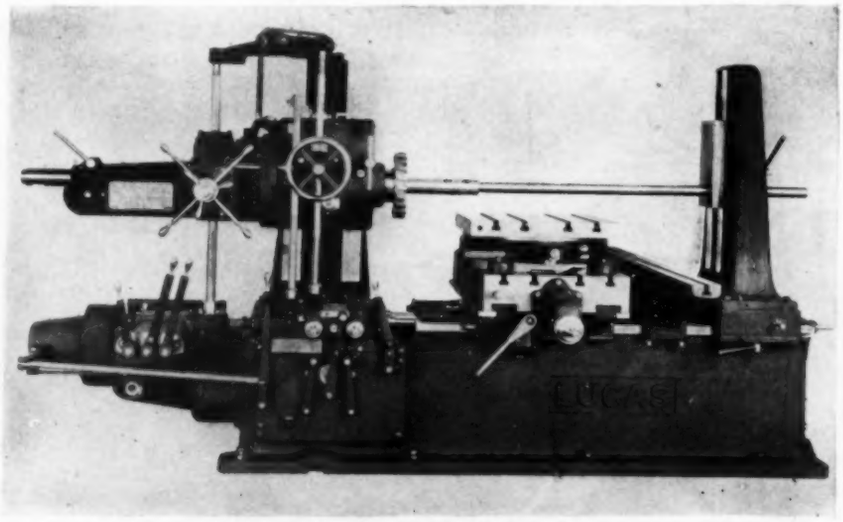


Fig. 1—Lucas Model 41 Precision, Horizontal Boring, Drilling and Milling Machine

ing ball-thrust bearing. The lever which operates the elevating screw beneath this bearing is interlocked with the indexing lockbolts. An improved split-ring-type of clamp, operated from the front left corner, simultaneously binds the table against rotation and clamps it firmly to the top surface of the baseplate.

In the close-up view of the No. 41 machine, Fig. 2, is shown a special indexing device using a pair of dial indicators graduated in half-thousandths of an inch, and carried in holders adjustable along strips on the column and at the side of the table. Suitable troughs are provided to hold standard $\frac{5}{8}$ in. round-end measuring rods, special length-gages, inside micrometers, or the like, between the indicators and fixed abutments on the top of the head and side of the saddle casting.

Accurate Measuring Equipment

Use of these dial gages has an advantage over ordinary micrometer dials on precision-traverse screws, because the latter are subject to wear after continued use, especially on a machine employed for milling as well as boring. The dial arrangement is useful in such original operations as accurately spacing holes in large jigs or in special machinery, for example,

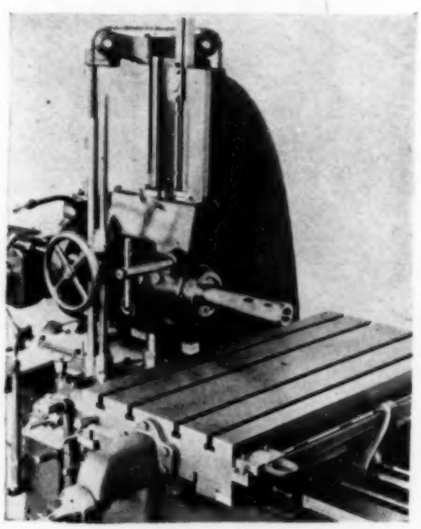


Fig. 2—Detail of Lucas Model 41 Horizontal Boring Machine, showing application of dial indicators

and also in repetitive work, especially on jobs in which the first cost of box jigs is excessive or their maintenance too expensive.

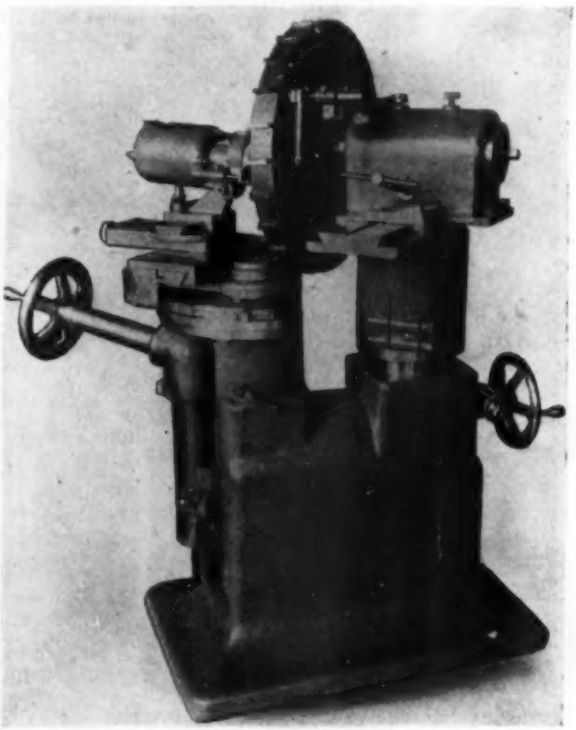
Oliver No. 2 "Arc" Face-Mill Grinder

THE No. 2 "Arc" face-mill grinder introduced by the Oliver Instrument Company, Adrian, Mich., is a heavier type of machine than the present design. The recently developed machine grinds face mills up to 26 in. in diameter with fine- or coarse-pitch blades, set either straight or helical, with any desired angle between face and periphery, any desired face clearance, any other desired peripheral clearance, and any required radius at the corner from zero (a sharp corner) to 2 in. The grinding is accomplished with but one setting of the cutter and one pass of the wheel over the face of the cutter.

The movements are so controlled that a turn of the operating wheel causes the grinding wheel to traverse the face, turn the corner, and traverse the periphery in one continuous movement. The corner is always a perfect arc of a circle tangent to the face and periphery and there is no angle to burn and start dulling until sufficient work is done to dull the complete cutting edge. There is also a saving in grinding time, because there are less settings of the cutter and less strokes of the grinding wheel required, while the setting of the machine takes no longer than usual.

The cutter is mounted on a spindle in the same way that it is mounted on the milling machine where it is to be used. It is then moved on the slides until the corner of the tooth is over the center of the rotation of the motor slide (set to a gage) and rigidly clamped in this position. The motor is then traversed around the cutting edge by means of the operating wheel. Means are provided for the mounting of an indicator in such a position that the teeth may be indicated on face and periphery before removing the cutter from the machine, to insure accuracy in grinding. Lip rests are provided for grinding various other types.

The spindle has the standard spindle nose and revolves on Timken roller bearings. A spindle-lock is provided, and a binding screw for holding the spindle in a given position while mounting cutters. The spindle bearing has adjustment in three directions, two providing movements to accommodate cutters of varying diameters and widths, the other (vertical) movement provides adjustment for obtaining different clearance angles on the face and the periphery. These adjustments, when made, are all positively locked, giving the cutter a support that is very rigid.



Oliver No. 2 "Arc" Face-Mill Grinder

The grinding wheel is direct-connected to the shaft of a $\frac{1}{4}$-hp. 3,600 r.p.m. ball-bearing-equipped motor, adjustably mounted on a carriage that traverses a slide. This slide is rigidly attached to a heavy vertical shaft mounted on heavy Timken bearings

directly in the pedestal casting. Adjustment for angles of face and periphery is obtained by large graduated protractors that are easily and accurately set.

Cincinnati Gear Burnisher

A gear burnisher is being introduced by the Cincinnati Shaper Company, Cincinnati, Ohio. Burnishers previously furnished handled gears up to 7 in. in diam. This

Cincinnati Gear Burnisher

burnisher handles gears up to 12 in. in diam. and may be arranged to take larger gears.

One feature of this model is the method of counter-weighting. The pressure with which the burnishing gears engage the green gear is fixed by means of counter-weights that permit a movement of the carriage slide sufficient to compensate for any small variation in the pitch diameter of a run of gears.

Tuthill Model H High-Pressure Oil Pumps

A series of high-pressure oil pumps for the hydraulic transmission of power has been developed by the Tuthill Pump Company, 131 West 63rd St., Chicago, Ill. These pumps are termed Model H, and are supplied in four sizes ranging in capacity from 12 to 50 g.p.m. against pressures up to 1,000 lb. per square inch.

Chief among the advantages claimed are the direct motor-drive feature and the flexibility of mounting and piping. In mounting, a circular flange replaces the foot-type so that Model H can be built into the machine, thus allowing the torque to be absorbed more directly than through an adapter bracket. An angle-flange for foot-mounting is available to manufacturers who prefer this conventional type of mounting.

An adapter flange is also used for

Tuthill Model H High-Pressure Oil Pumps

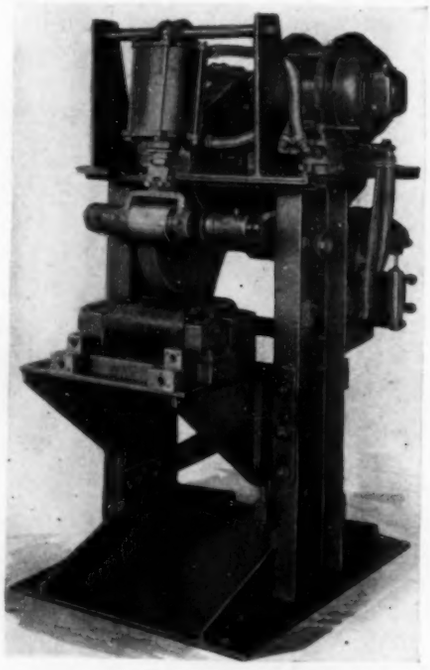
both exhaust and intake ports instead of the conventional pipe-threads. This feature permits the use of the manifold best suited to each individual installation, and simplifies piping and reduces cost. It also provides for mounting the pump in any position.

The design of Model H pumps automatically does away with the possibility of trapping the liquid when the gear-teeth mesh. Housings and end covers are close-grained, semi-steel castings with flat surfaces ground to a high finish so that no gaskets are required. Bolt spacing on covers is very close to prevent leakage and distortion under pressure. Shafts and gears are built of alloy steel, hardened and ground. Tolerances are maintained as close as 0.0003 in. Bronze bearings are generously proportioned and shafts turn in them on each side of the gears. All parts are interchangeable and many parts are common to more than one size, which simplifies stocking of replacement parts.

Ryerson Flue-Cutting and Polishing Machine

A flue cutting and polishing machine has been developed by Joseph T. Ryerson & Son, Inc., Chicago, Ill., for locomotive flue-shops where boiler tubes and flues are welded by the electric butt-weld method. This machine combines the two operations of cutting off the fag end of the tube or flue, and polishing the end that is to be placed in the welder. The machine has a welded steel frame on which is mounted a bracket with two large spiral rollers to hold the tube. When a tube is placed in position an overhead drive roller, operated by an air cylinder, is brought down on top of the tube, rotating it over the two spiral rollers. This causes a slight scraping action against the tube, removing the scale and exposing the bare metal.

A separately-operated cut-off attachment is mounted on the machine and is operated by an air-cylinder arranged with an oil dashpot to provide slow movement of the arm. A cut-off disk at the end of this arm is brought down on the tube that is being rotated and cuts off the fag end of the tube while it is being polished. Both cylinders are operated from one air-valve, which allows first the drive roller to come down on the tube and later the cut-off disk. The machine is driven by a 5-hp., 1,200

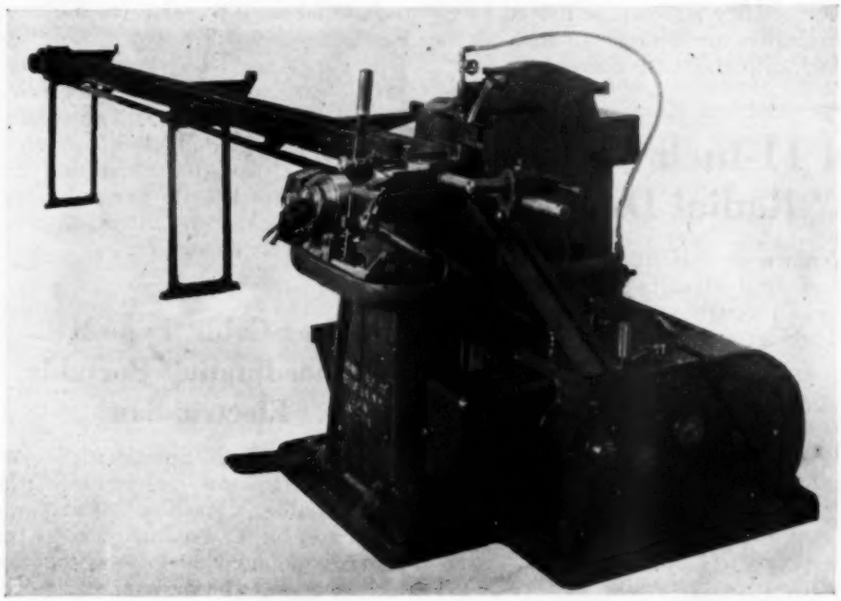


Ryerson Flue-Cutting and Polishing Machine

r.p.m. motor and will handle tubes from 1½ to 6 in. in diameter. This machine will polish and cut off a flue in less than one minute.

Cochrane-Bly No. 21 Automatic High-Speed Saw

THE No. 21 automatic high-speed saw has been introduced by the Cochrane-Bly Company, Rochester, N. Y., for cutting non-ferrous metallic tubing, rod, strip, and extruded sections, and also fiber, Bakelite, hard rubber, wood, magnet steel, and drill rod.



Cochrane-Bly No. 21 High-Speed Saw

A positive clutch connects the drive shaft with the camshaft operating the carriage, and depression of a treadle engages the clutch. If the treadle is released the carriage will stop at the end of the back stroke, but if the treadle is held or locked, with means provided, the machine will run continuously. The forward or cutting stroke is at a uniform speed with quick return. The vise remains open during 25 per cent of the cycle, allowing sufficient time for the bar to be moved.

The spindle is mounted in Timken roller bearings in dustproof cases. The carriage slides on dovetail ways fitted with an adjustable taper gib. The speed box provides a wide range of feeds obtained quickly by shifting the quadrants to positions indicated by a chart furnished with the machine. The range of 5 to 50 strokes per minute compensates not only for variations in the hardness or machinability of the material, but also for the variation in stroke or movement of the carriage to cut the maximum and minimum sizes and sections. The stroke of the carriage is adjusted by loosening one nut and turning a crank. The adjustment of the carriage with relation to the vise is made in the same manner.

The vise is adjusted and opens and closes automatically in timing with movement of the saw carriage, and the movement of the vise jaw can be adjusted from nothing up to $\frac{1}{2}$ in., which allows ample clearance.

The machine is usually equipped with pump and connections to deliver a suitable cutting lubricant on the blade or wheel. An adjustable nozzle permits correct position of the stream for various sizes of bar or tube.

Special vise jaws and fixtures can be furnished for holding two or more bars at one time and for special and odd shaped extruded bars.

Motor drive, as regularly furnished, is by a 5-hp. 1200-r.p.m. motor, but, where the machine is required to cut a large variety of metals of varying mixtures or a large variety of sizes varying from small thin tubes to heavy solid sections, it is necessary to use either a variable-speed D.C. motor or a multiple speed A.C. motor.

The automatic bar feed is driven by a separate motor and will feed 4 in. with the machine running at 50 strokes per min., and proportionately longer feeds at slower speed or any length up to the maximum length of bar, when the machine is tripped for each cut. When machines are suitably located, one operator can run two machines on a large variety of work.

The standard saw blade is $\frac{3}{32}$ in. thick, but other thicknesses may be used. An abrasive wheel may also be used for cutting hard materials. Specifications are as follows: Diameter of saw blade, 16 in.; maximum capacity, rounds, 4 in.; movement of carriage, $\frac{1}{2}$ to $4\frac{1}{4}$ in.; adjustment of carriage, $3\frac{3}{4}$ in.; number of strokes per min., 5 to 50; number of feed changes, 6; floor space, belt or motor drive, 50x60 in.; floor space with 15-ft. automatic feed, 60x240 in., and net weight, belt drive, about 3,000 pounds.

Goddard & Goddard Inserted Blade Cutters

A line of milling cutters with inserted blades is being introduced by the Goddard & Goddard Co., Inc., Detroit, Mich. This line includes small facing cutters from 3 in. to 7 in. in diameter, applicable to the new national standard shell end-mill arbor; right and left-hand spiral facing cutters adaptable to milling-machine spindle noses ranging from 8 in. to 20 in. in diameter; right and left-

A Goddard & Goddard Inserted, Serrated-Blade Milling Cutters

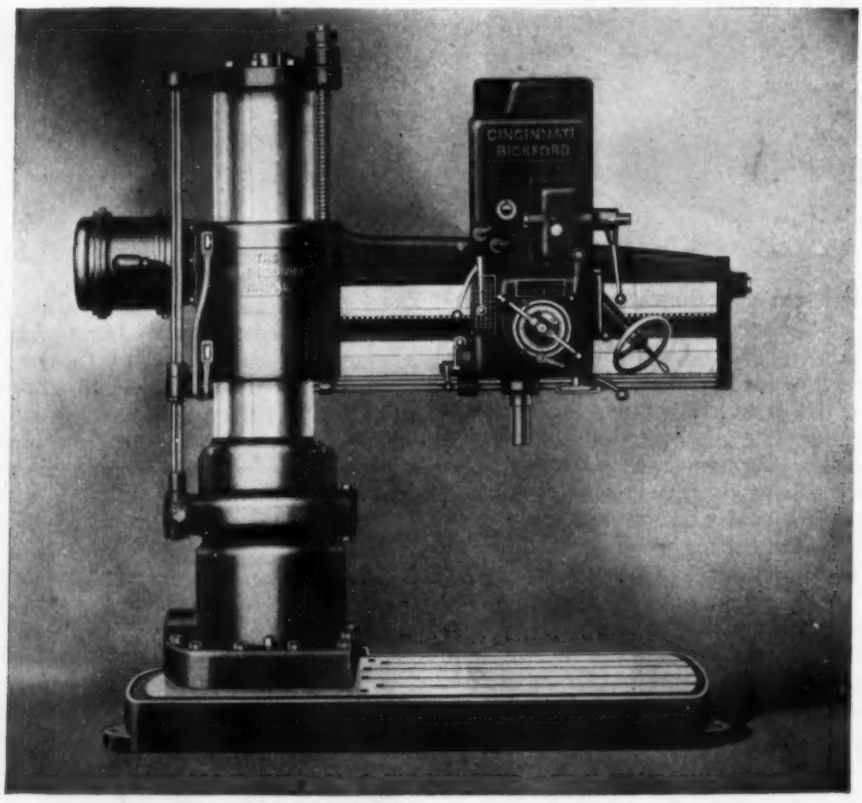
hand spiral straddle mills from 4 in. to 20 in. in diameter; and alternate-tooth cutters ranging from 4 in. to 8 in. in diameter, and from ½ to 1 in. in width. Only eleven sizes of blades are required for the maintenance of the entire line thus far developed.

All these cutters are fitted with inserted blades having machined serrations on the backs which mate with corresponding serrations in the back of the body tooth slot. This design obviates the possibility of the blades tipping or slipping radially in service. The serrations more than double the frictional contact area in the back of the tooth. A flat wedge is used in front of the blade. Accuracy of workmanship and the use of seizing angles in the design of the wedge are said to eliminate the need for any other fastening to keep the wedges seated.

Tooth serrations run parallel to the axis of the cutter and are spaced on a $\frac{1}{16}$ in. pitch, so that the blades may be moved radially in multiples of that unit. They also can be moved longitudinally any desired amount as the face chip clearance decreases.

Cincinnati Bickford 11-Inch Column "Super-Service" Radial Drill

THE Cincinnati Bickford Tool Company, Cincinnati, Ohio, has added an 11-in. column machine to its line of "Super Service" radials. feature of this machine. All speed and feed changes are made in the head through selective sliding gears. Tumbler gears, loose keys, and drive



Cincinnati Bickford 11-Inch Column "Super-Service" Radial Drill

This machine is built with 3- or 4-ft. arms and with 24 speeds in the head from 29 to 1,850 r.p.m. The arm is of full box section and has no openings in the front or rear wall.

Complete centralized control is a key mechanisms have been entirely avoided. Column clamping is controlled at the head.

The arm is raised or lowered, and clamped or unclamped, by levers near the spindle. An interlocking arrangement prevents raising or lowering the arm while clamped, but when unclamped, it is easily raised or lowered by multiple disk clutches running in oil.

Ample lubrication, including an oil filter, insures operation over a long period without oiling, squirt-can attention being therefore unnecessary. The entire drive from motor to spindle-nose is mounted on standard ball and roller bearings.

A rapid hand-traverse for the head has been developed which makes a power-traverse attachment unnecessary on machines of this size. The head is supported by an adjustable roller bearing gib, on a hardened steel arm-way. All shafts are ground and multiple-splined with integral keys. One motor, of constant-speed type, drives the entire machine.

Porter-Cable Type K-8, "Speedmatic" Portable Electric Saw

The Type K-8 "Speedmatic" portable electric saw offered by the Porter-Cable Machine Company, Syracuse, N. Y., has no gears as the blade is mounted directly on the motor armature, which runs on two precision ball bearings of the unit type, with dust seal. These bearings have a load capacity of 100 lb. and are lubricated through two grease cups. The device weighs only 12 lb. and can be easily operated with one hand while the other holds the work.

The base is made of duralumin and measures 10½ x 5 in. It is fastened to a segment which, in turn, is dove-tailed and gibbed onto the motor housing. Adjustment for depth or angle cutting is made by turning a thumbscrew in both cases, each adjustment being independent of the other. There is a 1¼ in. depth-adjustment range. An 8 in. blade cuts from 1 to 2¼ in. in depth, a 6 in. blade from 0 to 1¼ in., thus providing ample range for cutting out flooring, dadoing, slotting and similar work. Any angle up to 45 deg. may be cut and at this angle an 8 in. blade cuts 2¾ in. into the wood. The reason for this ½ in. increase in cut is due to the pivoting of the base which allows the motor and blade to tilt closer to the wood. A 1½ in. round shaft allows the use of standard saws and dado

cutters. Dados recommended are 5 in. in diameter and up to ½ in. wide, with a ¾ in. maximum depth of cut.

Although the guard is cut away at the point where the blade enters the wood to permit accurate cutting by making the blade easily visible, the saw blade is fully guarded at all times, even when cutting at an angle. The guard consists of two parts, the upper part being fastened to the frame, while the guard covering the lower

Porter-Cable Type K-8 "Speedmatic" Electric Saw

part of blade is hinged to the fixed guard and held in position by a small coil spring.

The saw is powered by a special universal motor of ½ hp. rating, which can be operated on any correct voltage alternating current of 25 to 60 cycles, or on direct current. The saw blade is driven at 10,000 r.p.m. Brushes and commutator may be inspected and cleaned as they are in full view through the air intake. The handle is a pistol grip, easily grasped, and equipped with a 10-amp. switch readily controlled by the index finger. This switch must be held while saw is in operation and automatically shuts off when released.

The motor-cooling fan is built onto that part of the armature shaft which is inside the blade guard. Thus the fan can not get loose and injure the motor windings. Air is drawn in by this fan through the intake at the commutator end of the motor housing, passes around the motor and is exhausted inside the saw guard. The sawdust is blown out and away from the operator, thus keeping the work clean and preventing the guard from becoming clogged.

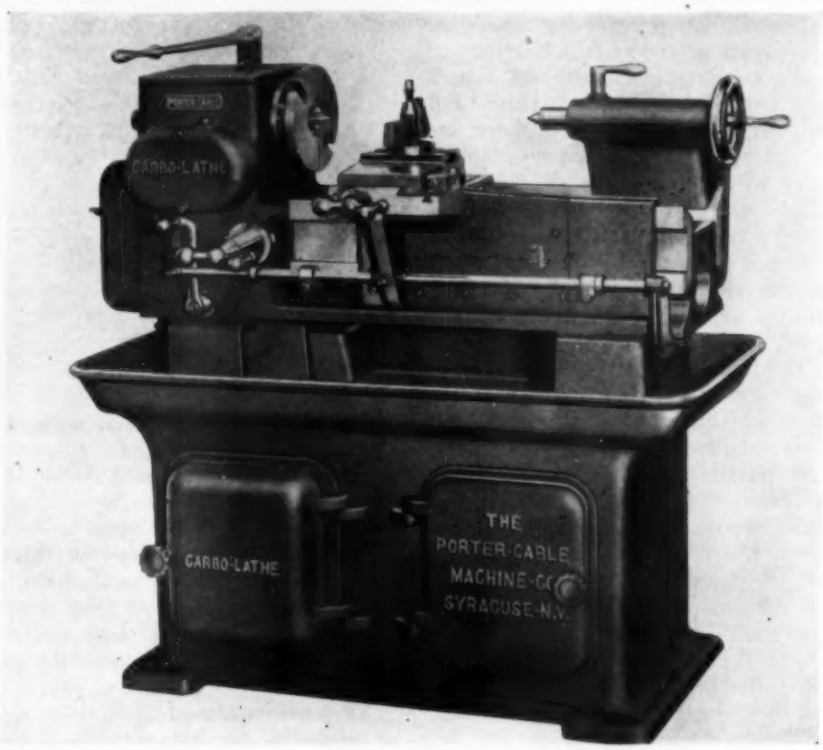
Specifications: 110 volts (220 and other voltages can be furnished); saw blade 8 in. in diameter, ½ in. hole; saw speed idle 10,000 r.p.m.; size overall 11¾ in. long, 6½ in. wide, 10⅜ in. high; blade is 10½ in. x 5 in. wide; net weight— 12 lb. Standard equipment includes: One 8 in. combination saw blade for cross-cutting and ripping; 15 ft. of rubber-covered connector-cable with unbreakable duplex plug; adjustable ripping gage; combination wrench and screw- and triangular cross-cutting guide.

Porter-Cable 12x18-Inch "Carbo-Lathe"

BECAUSE of the advances in cutting alloys, the Porter-Cable Machine Company, Syracuse, N. Y., has offered to the trade a production lathe that incorporates features of its early lathe, including the worm gear drive, together with several improvements both in construction and design.

Although the "Carbo-Lathe" is built to use tungsten carbide as a cutting agency, no efficiency is lost when high-speed tool steel is employed. The keynote of this 12x18-in. production lathe is simplification of design. There are only four major parts used in its entire construction. The advantages of such a design are, ease of operation, low upkeep cost, and fewer part replacements. Rigidity is obtained by having the headstock and the bed in a single casting of chrome-nickel iron, thus doing away with weaving of the headstock. The tailstock is of heavy one-piece construction, and is rigidly clamped to the bed by two draw bolts on a heavy gib. The ways are relieved in the center to give a two-point contact. In this manner rigidity of the tailstock is secured, preventing rocking. The centers are made from high-speed steel and have a No. 3 Morse taper. The base is a cabinet design of one-piece construction, containing the chip pan, oil reservoir, and short legs upon which the bed is mounted. The small size and low center of gravity of the lathe are an advantage when floor space is at a premium, as it can set in a space 34x48 inches. The spindle height from the floor is 42 in. while the highest part of the machine is only 48 inches. Its low height does not obstruct the light.

Power is furnished by a motor of 3 or 5 hp., concealed in the cabinet base, although direct line drive can be used if desired. The motor is



Porter-Cable 12x18-Inch "Carbo-Lathe"

mounted on a hinged plate, doing away with idler pulleys, as the weight of motor is sufficient to take up the slack in the 3-in. belt that drives the clutch pulley. This pulley is mounted on ball bearings on the clutch shaft. The disk clutch gives smooth control and a steady pull. It is so constructed that immediate release is obtained at high speed even when heavy cuts are taken. Allowance is made for wear and the clutch is easily adjustable. The control lever that operates the clutch also applies the brake that stops the spindle. Power is transmitted to the spindle through spiral and worm gears, while the feed is driven by spur and worm gears.

Spindle change feed gears are furnished to give a ratio from 9.1 to 1 maximum, to 1.75 to 1 minimum, between the clutch shaft and spindle. Two-speed motors are especially adaptable as a power unit on this lathe. Carriage feed gears are provided and the following feeds can be obtained: 0.005, 0.010, 0.015, 0.020, 0.025, and 0.030 in. These pick-off gears are standard equipment. The spindle revolves on Timken roller bearings and the adjustment of the spindle bearing can be made through a nut on the back of the spindle. The spindle has a $1\frac{7}{16}$-in. hole entirely through it. Other revolving shafts are carried on precision ball bearings.

The construction of the bed is such that both lubricant and chips fall through the center. Also there are no flat spots on the bedways, doing away with chips piling up and jamming underneath the carriage. This construction of the ways also allows a larger swing over the bed-ways. Another feature is the automatic shut-off of the coolant as the spindle stops.

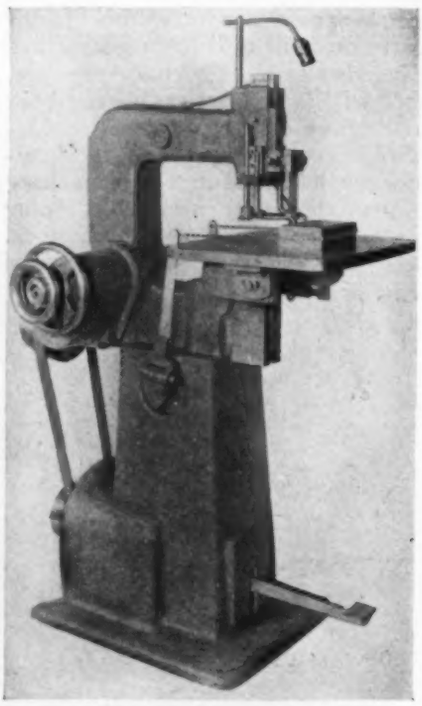
This lathe is especially designed to take care of short pieces of not over 18 in. in length and 7 in. in diameter. It is adapted for secondary operations on screw-machine parts, pistons or forgings, and for turning pinions, gears, bronze or iron bushings, shafts, piston rings, and similar parts, at the correct speed and feed required by the tungsten-carbide and high-speed steel tools.

The facing attachment is movable along the bed, is rigidly clamped to tailstock shears in any position, and is driven from a rack in the bed ways. The cross-slide ways are flat in type, accurately gibbed, and adjustable to compensate for wear. The cross-slide is cam operated, allowing fast and slow speeds, with quick return. Maximum of travel is 3 in. with a dial adjustment of 2 inches. Timing in relation to the carriage can be secured by pick-off gears.

A wheel operated tailstock is standard equipment, but it can be changed over to a lever action by removing wheel parts and substituting lever mechanism. A spring is used in the tailstock and the correct tension is obtained for light or heavy work by adjusting a screw. An air cylinder up to 6 in. in bore can be used for operating chucks, collets and expansion arbors. Other attachments that can be furnished are: Lever chuck closer, taper attachment carriage, and turret.

Oliver Heavy-Duty Die-Making Machine

THE heavy-duty die-making machine developed by the Oliver Instrument Company, Adrian, Mich., is a precision machine tool designed for the rapid and accurate production of dies, tools and similar work. It is adapted to both filing and sawing on work up to 3 in. thick, and is claimed to have ample weight and power for the heaviest work.



Oliver Heavy-Duty Die-Making Machine

The table is 16 in. square, has a true surface, and tilts in four directions. There is a clear distance of 16 in. back of the file. The stroke is adjustable from ½ to 3 in. and six speeds are available through cone and sliding gears.

The mechanism for holding and reciprocating the files consists of two rams, one above and one below the table. These rams are sufficiently large to provide ample wearing surface and are oscillated in unison through arms and a connecting rod. The bearing surfaces of the rams are hardened and ground steel plates which can be adjusted to keep the rams always in alignment. Each ram has provision for adjustable clamps to hold files and saws accurately in line. Parallel files requiring no preparation and saws of any type may be used.

The hold-down fingers, saw guides, or other attachments, are held to the upper ram housing where they are always in position and do not obstruct the table. A feeding mechanism has been developed by means of which a footpedal applies the feeding pressure, and this pressure may be relieved on the up stroke, if desired.

All gears and mechanism for operating the rams are inclosed in an oil-tight body and a geared oil-pump supplies lubricant to all bearings except the rams. An air pump also inclosed in the body gives a blast to keep the work clear of chips. Power is supplied by a 1-hp. motor in the base of the machine, where it is protected from dust and filings.

Oliver Tap Grinder

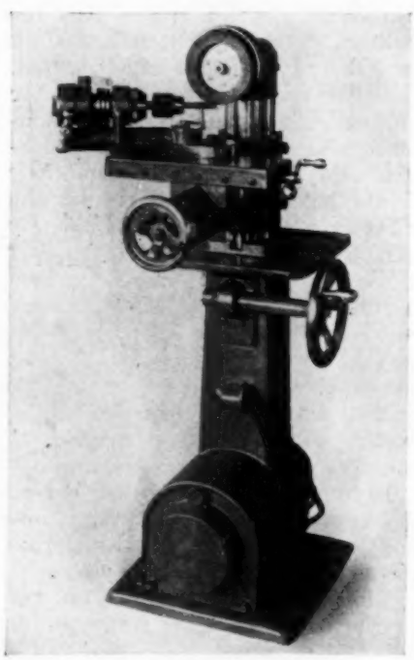
The tap grinder introduced by the Oliver Instrument Company, Adrian, Mich., cut-grinds all taps having a shank less than 1 in. in diameter, either right- or left-hand and having two, three or four cutting edges.

An eccentric relief is provided, the exact shape of which is determined by means of a formed cam. This cam may be altered to conform to any type of relief. Adjustment is provided for any desired angle of point, to accommodate taper, plug, or bottoming taps. The face or the flute may

be ground and the cutting face of a "gun" tap may also be ground. The tap is held in a chuck by the shank, since it is also held this way in the tapping machine. No center is necessary and taps may be resharpened until they are practically used up.

The machine carries a hollow spindle running on ball bearings. This spindle is mounted in an oscillating frame and the motion is controlled by cams contacting with a fixed roller that may be quickly adjusted for two, three or four-flute taps. A chuck, holding the tap, is mounted in the spindle and held by means of a knurled nut at the back. A lip rest is provided to locate the cutting edge of the tap on the center line.

An index plate having twelve notches provides means of accurately indexing two, three or four-flute taps, also a means of locking the spindle while mounting the tap to be sharpened. The spindle is revolved by means of a pair of helical gears and a crank. The entire spindle mechanism may be swung about a graduated base to obtain accurate angles for taper, plug, or bottoming taps. Right- and left-hand taps are ground in exactly the same way and with the same setting of the head, it being necessary only to locate the cutting edge of the tap at the center line. The machine is operated by a ½-hp. motor.



Oliver Tap Grinder

Reed-Prentice No. 5 Jig Boring and Vertical Milling Machine

A MACHINE, which is capable of vertical milling, with precision to meet the requirements of jig boring work, has been placed on the market by the Reed-Prentice Corporation, Worcester, Mass. This machine, which is designated as the No. 5, weighs 11,000 lb. and occupies a floor space of 100 x 95 in. As a jig borer, the machine will bore, drill and ream. In addition it will mill die shoes, rout out the recesses, bore the leader pin holes, and do the necessary precision drilling, reaming, and boring in jigs and fixtures. Power down feed for the spindle is built into the head as shown in Fig. 2. There are three feeds, 0.0025, 0.005 and 0.01 in. These are operated through the lever shown at the right of the top gear-box.

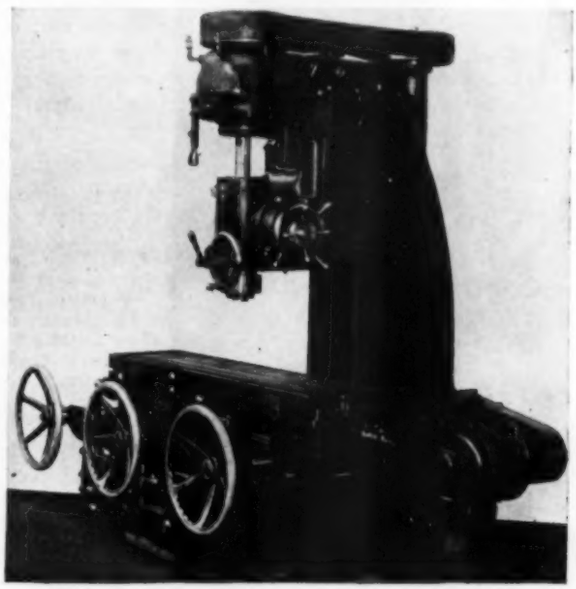


Fig. 1—Reed-Prentice No. 5 Jig Boring and Vertical Milling Machine

The accuracy necessary for jig and fixture work is secured by means of brackets and V-blocks for holding measuring bars as shown in Fig. 4. These bars, in combination with a micrometer head, Fig. 3, are placed between the adjustable stops and the dial gages attached to both the saddle and the table. The two micrometer heads and twelve measuring bars, shown in Fig. 4, provide means of measuring from zero to 12 in. in steps of 0.0001 inch. Holes are located accurately in either the cross or the longitudinal direction by direct readings. Positioning of the table and work is positively controlled by the measuring bars in connection with the outside and inside micrometer heads and dial indicators. The feed screws are not used for this purpose. A clamping device locks the table to the bed of the machine to provide rigidity and accuracy.

An electrically-operated indicator, shown in Fig. 5, provides means for quickly setting work in line with the spindle. This mechanism consists of an electric bulb operated from the light circuit with a transformer connection, and is complete with all necessary equipment.

The extra equipment supplied with the machine consists of a rotary table, 20 or 24 in. in diameter, graduated to 360 deg., with a micrometer dial, hand or power feed, a sub-table, boring tools, spotting tools, adjustable boring head, boring bars, collet chucks and collet and a high-speed drilling attachment complete with a drill chuck.

Vernier scales can be furnished for cross and longitudinal feeds in place of the measuring rods and dials.

The box-section base is reinforced and webbed to provide rigidity. Four wide bearings form rigid supports for saddle and table. The column is of box section amply reinforced and webbed to withstand strains.

The saddle supports the entire table and has a four bearing mounting on the base. Longitudinal and cross feed screws are vanadium steel, threads finished by lapping. Feed screw nuts are of phosphor bronze. Both the cross and longitudinal feed screws are mounted on Timken bearings.

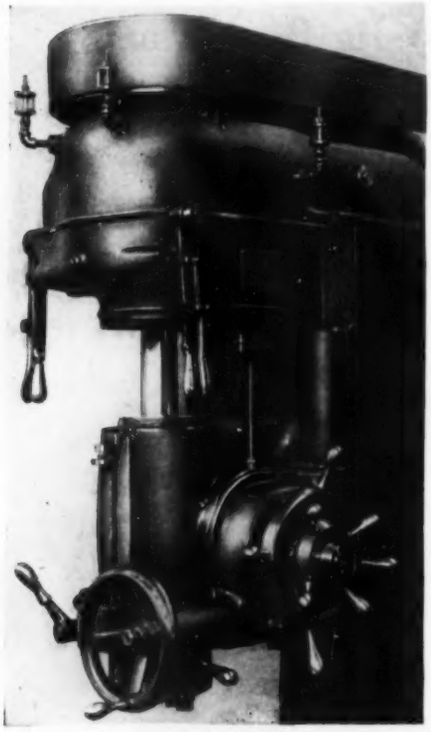


Fig. 2—The power down feed is built into the head as shown

The spindle is of heat treated and forged chrome-vanadium steel, with clutch drive nose and standard milling machine taper of 3½ in. per foot. It operates in Timken roller bearings with adjustment for taking up both radial and thrust loads, and is fitted with graduated scale and micrometer stop also, with slow worm and worm gear feed operated by handwheel at the front, or by direct connection at the side through a large spider handwheel. Positive power feed can be supplied extra.

The speed box has Timken bearings on all shafts. Gears are of S.A.E. 6250 nickel-chromium steel, hardened and running in oil. All shafts are of the multiple splined type. The vertical shaft is driven through spiral bevel gears. Speed changes are made from the front of the machine.

The speed plate shows eighteen spindle speeds, from 17 to 600 r.p.m. Plate is attached to front of machine where convenient levers allow operator to change speeds from operating position. Higher spindle speeds can be obtained if desired.

Fig. 3—Micrometer head for use with the No. 5 jig borer

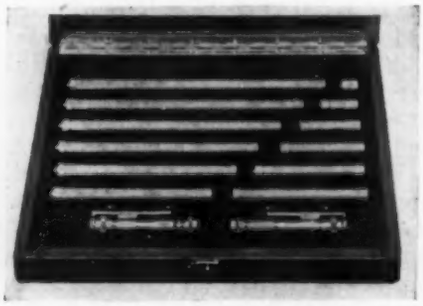


Fig. 4—Spacing bars for use with micrometer head in Fig. 3. The range is to 12 inches

SPECIFICATIONS

RANGE:	
Longitudinal power feed	48 in.
Cross power feed	16 in.
Vertical adjustment head on column	15 in.
Vertical feed on spindle	9 in.
Maximum distance end of spindle to table	20 in.
Throat depth	20 in.
Distance center line of spindle to face of column	11¼ in.
RAPID POWER TRAVERSE, EITHER DIRECTION:	
Longitudinal (per minute)	100 in.
Cross (per minute)	100 in.
TABLE:	
Working surface	60x16 in.
Size overall	68x16 in.
T-slots, 3	⅝ in.
Height above floor	33 in.
SPINDLE: Heat-treated, forged, nickel chrome-vanadium steel; flange-type nose	
Size taper hole	No. 12 B. & S.
Hole through spindle	1 1/16 in.
Spindle speeds, number	18
Range spindle speeds, minimum and maximum	17 to 600 r.p.m.
Number feeds for each spindle speed	8
Feed range for 18 speeds	.002 to .297 in.
Diameter spindle sleeve	6½ in.
Single pulley drive, friction start and stop	
Shipping weight	11,000 lb.
Floor space, width x depth x height	100x95x98 in.

The multiple-disk Edgemont clutch is operated by a convenient lever located at the front of the machine. The mechanism also includes a cone brake for quick stopping. Simplicity and ease of adjustment are features of this clutch and brake mechanism.

The feed box is a self-contained unit giving eight feeds for each spindle speed, a total range from 0.002 to 0.297 inches. Feed gears are of heat-treated high manganese steel and run in oil on multiple-splined shafts.

Multiple V-belt motor drive is used for smooth operation. The motor is mounted on a hinged bracket with screw adjustment for maintaining belt tension. Positive chain drive can be furnished if desired, using same motor mounting with screw adjustment for maintaining chain tension.

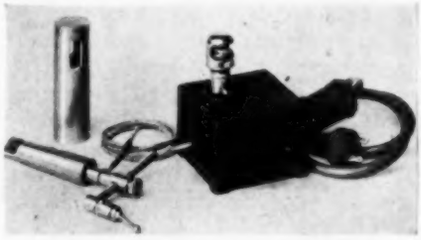


Fig. 5—Electrically operated indicator for locating work in line with the spindle

At extra charge, a cnerrying attachment for die sinking can be furnished, adding to the range of work that can be done by this machine. The bracket attaches to the spindle housing.

Oliver No. 21 Drill Grinder

The No. 21 drill grinder developed by the Oliver Instrument Company, Adrian, Mich., is a special type for drills of 3/32 to ½ in. It will produce the Oliver-type point, when desired, and also types of points adapted for countersinking, counterboring, chamfering and similar operations. Thick-web oil-hole drills and chamfering or nut-drills can also be ground, the latter type on point and shoulder.

In grinding, the heel of the drill is backed off to give more clearance to the chips and produce cleaner, smoother holes. The point angle may be varied from 60 to 180 deg., the smaller angles being adapted to drilling wood, slate, fiber and similar materials, and the blunter angles to counterboring and deep-hole drilling.

In this machine, the drill is located in a jig or fixture which drops into position in a holding mechanism on the machine.

The spindle is mounted on ball bearings in a swinging frame and is adjusted horizontally by means of a knurled knob. This horizontal adjustment is provided to obtain the amount of center clearance or undercut desired so that any type of point may be ground. It also provides for grinding shoulder drills, the point be-

ing ground in the usual way and reset for the shoulder. The wheel is then moved sidewise an amount sufficient to come in contact with the shoulder, which is ground in the same way as the point.

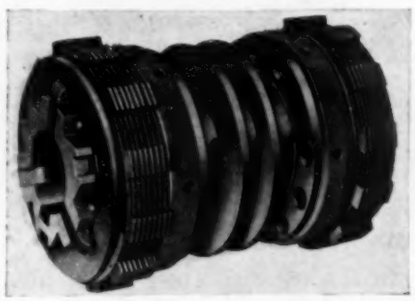
Oliver No. 2 Bench-Type Drill Grinder

The illustration shows the machine for bench use. The ½-hp. driving motor is inclosed in the base and drives the spindle through a flat canvas belt, an idler providing the driving tension.

"Twin Disc" Type C.C. Multiple-Disk Machine Tool Clutch

A multiple disk clutch design has recently been announced by the Twin Disc Clutch Company, Racine, Wis.

This clutch is designed to run in an oil-spray or bath, which, while preserving the characteristics of the



"Twin Disc" Type C.C. Multiple-Disk Machine Tool Clutch

type, avoids inherent difficulties that arise in operation. It is known as the C.C. type, and will be made in sizes from 3½-in. effective diameter of friction disks up to 6-in., varying by half inches, and also in 7, 8, 9, 10 and 12 in. effective diameters.

In the smaller sizes all parts are machined from the bar, except the driving plates which are of hard-rolled phosphor-bronze. All steel frictional surfaces are hardened and ground, and care is taken to insure straightness and parallelism.

Centrifugal force operates to release the pressure levers, which are housed in the hub itself. These pressure levers are operated by sliding wedges, also guided and housed in the hub. No cotters or similar devices are used in the assembly, and it is impossible for any part of the clutch to become detached without disassembly. When installed there are no projecting parts, all visible portions are circular and the design is compact. The Twin Disc Clutch Company's method of adjustment is applied in a modified form to the smaller models, and is retained in its usual construction in the larger sizes. The clutch is suitable for duplex operation.

Hannifin Models WV-320 and WH-250 Wedge-Type, Air-Operated Rivet Presses

ALTHOUGH primarily designed for riveting operations, the wedge-type air-operated riveting presses made by the Hannifin Manufacturing Company, Chicago, Ill., are adaptable to other squeezing operations that require comparatively high power throughout a short ram movement. Both machines are very heavily constructed to prevent springing.

Fig. 1—Hannifin Model WV-320 Rivet Press. Fig. 2—Hannifin Model WH-250 Rivet Press

Simplicity has been the keynote in design of these presses. The only moving part that is exposed is the ram, and only five points require lubrication. The frame casting is of open-hearth steel, cast in one piece. The operating cylinder is double acting and does not use cup leather for packing.

The mechanism of the press operates on the wedge principle, whereby a wedge of predetermined taper is driven between two standard roller bearings mounted in the frame, and a roller mounted at the top of the ram. Forward movement of the air cylinder piston, driving the wedge between the rollers, causes a downward movement of the ram.

The wedge is provided with angles in two stages. The first angle is comparatively steep, so as to cause a rapid approach to the work. After the ram has approached the work, the angle of the wedge, which has been changed substantially, produces a power stroke that lasts during the final inch of stroke, thereby driving the rivet home solidly.

These machines are available in thirteen sizes in the vertical type, ranging from 5 to 80 tons ram pressure, and in eight horizontal models

within the same power range. There are also two portable models available, one of 5 tons and the other of ten tons pressure.

The two presses illustrated have specifications which are:

Model WV-320: Power, 18 tons, at 80 lb. air pressure; heads, $\frac{5}{8}$ in. hot rivet or $\frac{3}{8}$ in. cold rivet; gap, 12 in.; reach, 9 in.; cylinder, 12 in. bore, 12 in. stroke; air consumption, 10.2 cu.ft. of free air per cycle.

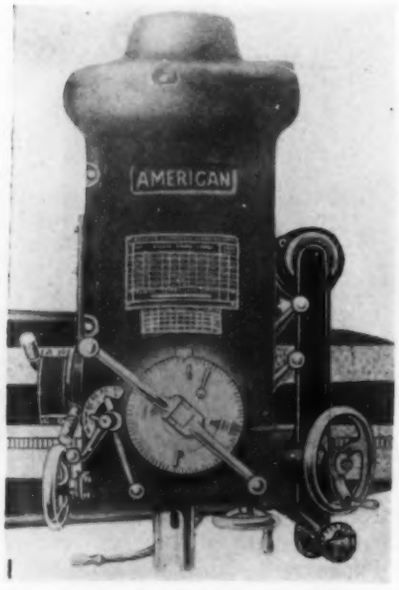
Model WH-250: Power, 12 tons at 80 lb. air pressure; heads, $\frac{7}{16}$ in. hot rivet, or $\frac{5}{16}$ in. cold rivet; gap, 12 in.; reach, 9 in.; cylinder, 10 in. bore, 12 in. stroke; air consumption, 7 cu.ft. of free air per cycle.

Control Mechanisms for "American" Radial Drills

THE American Tool Works Company, Cincinnati, Ohio, has introduced the improvements illustrated on its triple-purpose radial drills. In Fig. 1 is shown an electrical speed control operated from the head. The control of the electrical speeds provided by the rheostat is accomplished through a star knob which through a sprocket and chain connection operates the speed adjusting mechanism of the rheostat. This entire unit shown in Fig. 2. The unit is operated by a motor and switch mounted on the right-hand side of the head always ready for use whether the machine is running or not. The whole mechanism is a simple, compact, self-contained unit with a small control lever at the front with operates the motor control switch and automatically disconnects the hand traverse mechanism before starting the electrical power traverse.

A further safeguard is provided by the operator having to hold the control lever in engagement while traversing the head by power. The moment the operator releases the control handle it snaps back into the neutral position thus disconnecting the electrical circuit and stopping the motor. This also automatically reengages the hand traverse so that the head can be traversed manually. The motor runs only when the head is being traversed by power, consequently the power traverse mechanism is subjected to very light, intermittent duty which insures long life and dependable service.

Two other improvements, shown in Fig. 3, have been made and adopted as standard features on the 19-in., 22-in. and 26-in. column sizes. The one of greater importance is the relocation of the feed control levers, which are now placed at the extreme lower left-hand corner of the head



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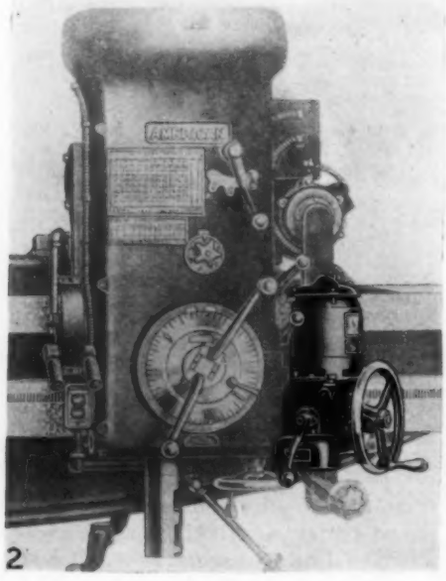
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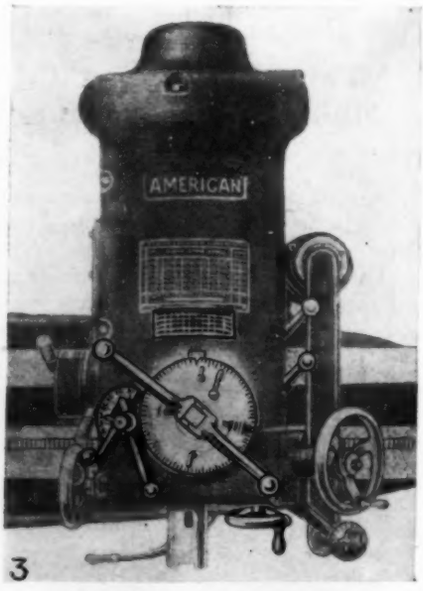

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Fig. 1—Electrical Speed Control from Head on "American" Radial Drills. Fig. 2—Electrical Power Traverse for Head. Fig. 3—Feed Control

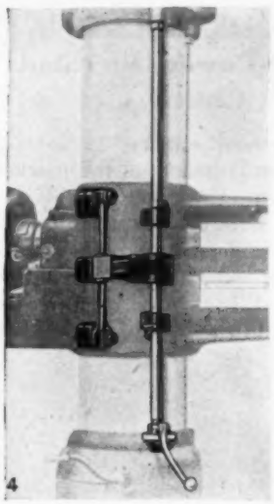
speed control mechanism is mounted directly on the head, thus eliminating the splined rod and bevel gears formerly employed for obtaining the same results. A graduated dial directly in back of the adjusting knob makes it possible to secure the desired speed almost instantaneously.

Another improvement is the independent electrical power traverse

When the power traverse is engaged the hand traverse is automatically disengaged causing the hand traverse handwheel to remain stationary and thus to prevent accident to the operator. The mechanism itself is guarded against accidental overtravel by limit stops at each extreme of the arm which automatically disconnect the motor circuit when the

where they can always be conveniently reached by the operator. The entire range of 12 feeds is secured through these two levers, while the correct lever position for any desired feed can be secured by reference to the feed index plate attached to the front of the head, as shown in Fig. 3 above.

The other improvement referred to



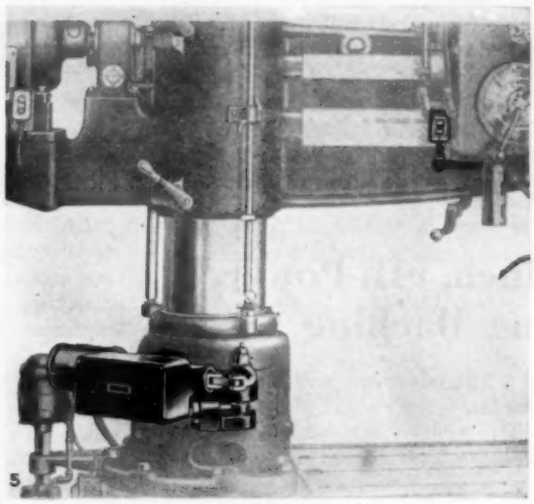


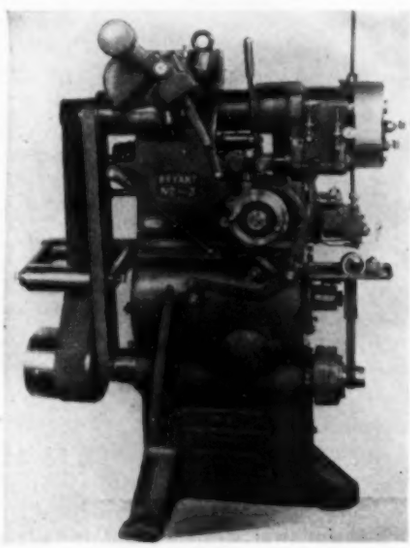
Fig.4—Unit Arm Clamping and Elevating Mechanism for American "Radial Drills. Fig. 5—Improved Column Clamp"

is the unit control for the arm through the single level located on the cuff of the column sleeve. See Fig. 4. Through this one lever the arm is either unclamped or clamped to the column sleeve and the elevating mechanism is engaged for raising or lowering the arm by power.

An improved electric column clamp, Fig. 5, is now available for all sizes. This clamp consists of a motor mounted on the column cuff and a forward and reverse push button on the head which through a screw and bronze nut operate the eccentric link for clamping and unclamping the column sleeve to the column.

Bryant No. 24 Deep-Hole Grinder

FOR internal grinding of long, large holes, such as airplane engine cylinder bores, the Bryant Chucking Grinder Co., Springfield, Vt., has announced a new and massive machine, said to be capable of an exceptionally high production rate combined with extreme accuracy. This machine, known as the Bryant No. 24, deep-hole grinder, is offered in three sizes for 21-, 31-, and 41-in. swing, respectively. It has a 14-in. grinding stroke. The weight of the different sizes ranges from 7,000 to 8,000 pounds.



Bryant No. 24 Deep-Hole Grinder

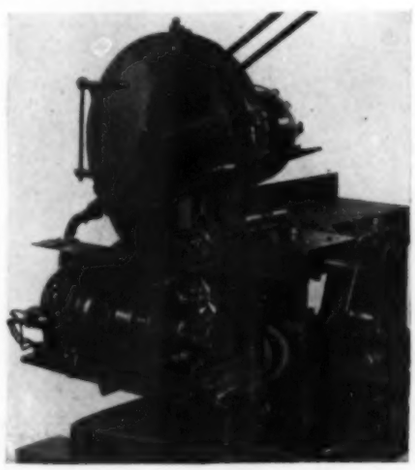
An idea of the large size of this machine can be gained from the fact that its work spindle is 5¼ in. in diameter and is carried in Timken roller bearings spaced 3 ft. apart. The overall length of the machine is 11½ ft. and the overall width 4 feet.

This machine holds to the same fundamental design used in other Bryant grinders with single-slide and hydraulic control, but is of considerably larger size. Automatic sizing features also are retained. The wheelhead is driven by a 10-hp. 3,600 r.p.m. motor through a 6-in. belt. A 5-hp. motor, mounted below the work spindle near the floor, drives the work spindle, at a speed of 100 to 200 r.p.m., and also drives the hydraulic pump, water pump and other parts of the machine. Ball or roller bearings are used on the work-wheel shaft and all other shafts. A 300-gal. coolant tank is provided.

Regular equipment includes a standard-size wheelhead, automatic sizing fixture, and oil and water pumps, but work-holding chucks are subject to separate quotation.

Work-Rotating Attachment for Ryerson No. 0 High-Speed Friction Saw

A rotating attachment for the No. 0 friction saw, developed by Joseph T. Ryerson & Son, Inc., Chicago, Ill., minimizes the burr in cutting round tubing, pipe, and bar stock. The No. 0 saw was desigend for manufacturers requiring a high production output in cutting smaller sizes of material. This new rotating attachment increases the capacity and at the same time reduces the load on the saw motor. It consists of a special work table on which are mounted supporting rollers for holding the stock in position while being cut. One set of rollers is driven by direct gearing from a fractional horsepower motor, through a speed reduction unit and gearing. A second set of rolls is mounted on an adjustable bracket which may be moved in or out to accommodate various sizes of stock. A third roller is brought down on top of the stock by means of an air



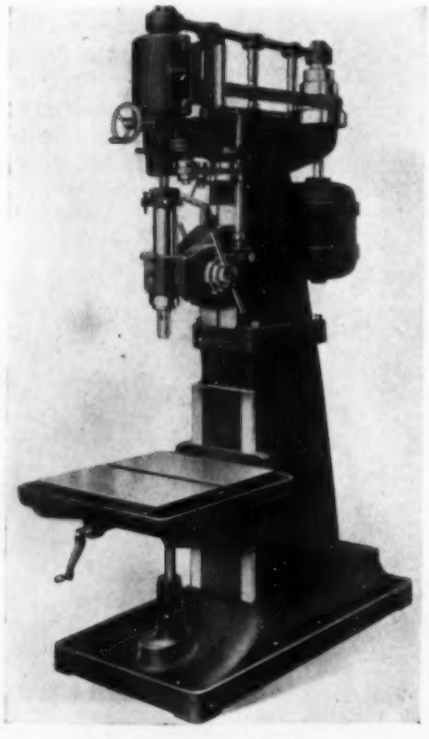
Work-Rotating Attachment for Ryerson No. 0 High-Speed Friction Saw

cylinder arrangement which holds the stock firmly in position while it is being rotated.

This attachment provides rotation of constant peripheral velocity to any size of round stock which may be placed in the machine, and eliminates chucking and change-speed gears. The machine may easily be changed for cutting structural shapes by dropping the drive rollers and replacing the adjustable bracket with a work-table plate. The main power unit is a 10-hp. motor of 3,600 r.p.m. The saw blade is of the standard hobbed-type and is 24½ in. in diameter.

Henry & Wright 7/8-Inch, "Hi-Power," Sensitive Drilling Machine

THE "Hi-Power" sensitive drilling machine has been designed and built by the Henry & Wright Manufacturing Company, Hartford, Conn., to provide a ⅞-in drilling machine with power and rigidity to drive the present drills at their maximum speed, and to anticipate the use of tungsten-carbide drills. Extra long bearing surfaces are provided. Attachments, such as power feeds, back-gears and motor-drives can be added at any time. Rotating parts are dynamically balanced to prevent vibration. The base is a heavy, box-type casting, the lower end being cast so as to provide a coolant reservoir that is protected from foreign matter by a hinged cover at the back of the column.



Henry & Wright ⅞-Inch, "Hi-Power," Sensitive Drilling Machine

The table is a large, ribbed casting having a long bearing surface on the base with an extra large chip and oil groove. The belt-drive, handfeed, single-spindle machine contains eleven ball bearings. The arm has a long bearing surface and is fastened by a quick-acting clamp.

An extra long bearing surface is provided for the spindle sleeve. The spindle sleeve is made from a semi-steel casting with an inserted nickel-steel rack. The spindle is an alloy-steel forging, dynamically balanced for operation without vibration. It has a minimum diameter of 1⅛ in. The standard spindle nose is furnished with a No. 2 Morse taper. Six splines are used at the upper end of the spindle. A cap on the upper end of the spindle sleeve contains an oil reservoir of large capacity, and has a sight glass. Wick feed is used.

Four spindle speeds are obtained, ranging in geometrical progression from 620 to 1,800 r.p.m., and, with the back-gears, four additional geared speeds may be had. Spindle travel is 7 in. A power feed attachment gives full control of the feed by means of the pinion handle. Feed may be instantaneously changed from semi-automatic to full automatic or to handfeed. Standard feeds are 0.004, 0.008, and 0.012 in. per revolution.

Feeds may be full- or semi-automatic, but the drill may be advanced ahead at any point in the stroke without disengaging the feed. Either power or handfeed may be obtained at will. Two types of coolant pumps can be furnished, one for individual motor-driven machines, and the other for belt-driven machines. Multiple spindles are arranged at 12 in. centers.

Union 10- to 22-Inch Electric-Power-Operated Chuck

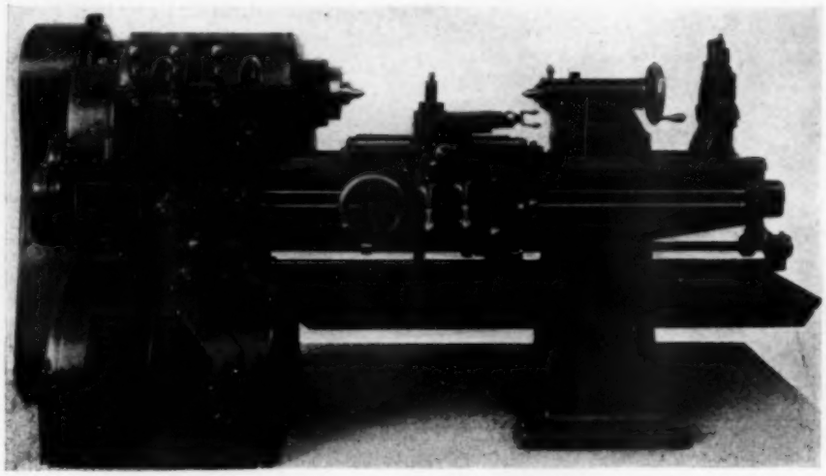
Electric power chucks, either a.c. or d.c., recently placed on the market by the Union Manufacturing Company, New Britain, Conn., are furnished internally-operated for chucking work, or externally-operated for chucking and bar work, and power pressure controlled from 500 to 6,000 lb. The pressure can be changed by the operator in accordance with the work to be done. The internally-operated chuck is operated by push-button control, the externally-operated chuck by a lever, which automatically opens and closes the jaws. The jaws can be used at either the maximum or minimum capacity of chuck, without changing. There are no protruding shafts, levers, or other mechanisms that can catch the operator's clothing.

The controls are conveniently arranged for either foot- or hand-control. Foot-control leaves both hands free for chucking the work. With the control set at a given pressure the parts will come out of the machine with uniform dimensions. One operator can also run several machines. Chucks are of steel, with all working parts of chrome-nickel, heat-treated steel. They are furnished with either solid or reversible-top jaws as required, or for any class of special work, and are supplied in 10, 12, 15, 18, and 22-in. sizes. Motors from ⅓ to 1 hp. are supplied, depending upon the size of chuck and the pressure required.

Union 10- to 22-Inch Electric-Power-Operated Chuck

Lodge & Shipley 14-Inch, Selective-Head Engine Lathe

THE Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, has just completed a 14-in. selective-head engine lathe for either toolroom or production work. The parts are of liberal size, but the machine is easy to operate. The swing is 16½ in. over the bed and 10½ in. over the carriage. On a 6-ft. bed the distance between centers is 33½ inches, and in proportion on other lengths.



Lodge & Shipley 14-Inch, Selective-Head, Engine Lathe

Twelve hardened gears on ball-bearing-equipped, splined shafts give twelve spindle speeds. The gears revolve in oil, no mechanism being attached to the headstock cover. Bearings used on the machine are of the white-metal type.

The headstock is driven through a pulley having an improved type of disk-clutch, operated by levers at the apron and at the headstock. A feature is the reverse to the leadscrew, operated by a lever at the right of the apron. The stop bar for gaging purposes has been retained.

The leadscrew or feed rod, or both, can be thrown out of use through a clutch at the feed-box end. The double-nosed spindle, right-angle bearing of the carriage on bed, chilled ways of the bed, special compound rest that eliminates top-slide overhang, micrometer ball stop, and double levers for apron friction have also been retained.

The motor-base houses all the electrical equipment. The motor drives through a flat belt with a weighted idler pulley. The large door provides easy access to all motor equipment. All of the standard attachments, such as the taper attachment, draw-in chuck, and pan, can be furnished either when the lathe is ordered, or subsequently.

Stuart's "Drawsol" Deep-Drawing Compound

For the lubrication of deep-drawing of steel, copper, and brass parts, an improved lubricant, known as "Drawsol," has been placed on the market by D. A. Stuart & Company, 2727 South Troy St., Chicago, Ill. It is claimed by the manufacturer that this material offers the respective advantages of each of the three types of drawing lubricants now in general use, the types being as follows: (1) Soluble oil or paste type (used with water), (2) pigment type (used with or without water), and (3) heavy oil type (used straight). When used for the drawing of brake-drums, fenders, hub-caps, step hangers, and body sheets, the material has good adhering qualities. The usual mixture for heavy-duty work is one part of Drawsol to three parts of water. Lighter mixtures may be used according to the work. The one to three mixture makes a heavy solution of concentrated fats and water that follows through with the die, providing both ample lubrication and the correct degree of slippage where necessary. Drawsol when properly mixed with water will not separate, but will maintain its smooth, velvety consistency indefinitely. It is easy to remove, will not stain, and is a rust preventive. If parts are to be stored for long periods of time before final assembly, it is considered advisable, however, to wash the parts immediately after machining and dip them in a light slushing oil or compound particularly if they are intended for export.

"U. S." Multi-Speed Buffer and Polisher

The United States Electrical Tool Company, Cincinnati, Ohio, introduces a four-speed buffer and polisher, driven by 1, 2, 3 and 5 hp. a.c. motors of 220, 440, or 550 volts, 2 or 3-phase, and 25, 40, 50, or 60-cycles. The spindle is mounted on ball bearings and carries four Micarta disks

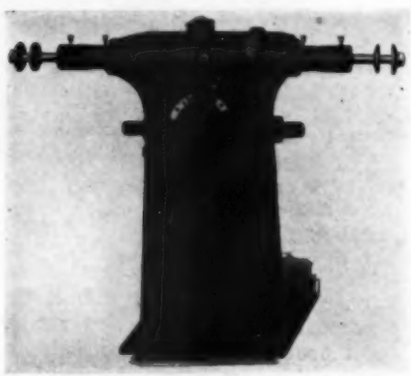


Fig. 1—"U. S." Multi-Speed Buffer and Polisher, front view

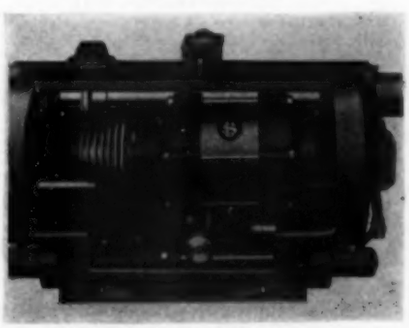
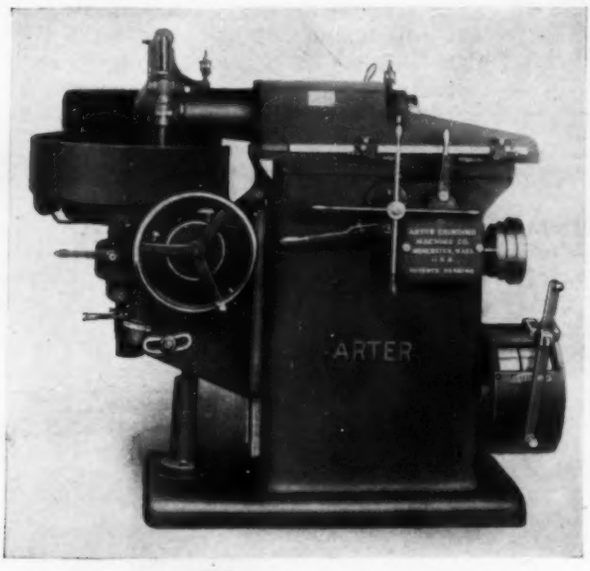


Fig. 2—"U. S." Multi-Speed Buffer and Polisher, rear view

in what is known as the Gibbs transmission. The speed ranges are from 2,000 to 3,000 r.p.m. and can be easily and quickly made. Other speeds can be provided when necessary. Control is by push-button mounted at the top, and has overload protection and no-voltage release.

Arter 12-Inch Rotary Surface Grinder

NUMEROUS improvements in design and operation are embodied in the 12-in. rotary surface grinding machine manufactured by the Arter Grinding Machine Company, Worcester, Mass. These improvements are of a varied nature. An improved brake has been adopted for the chuck spindle. Ball-bearings are now used in the main shaft, the main spindle belt idler, and in the loose pulleys. The size of the coolant tank has also been increased.



Arter 12 Inch Rotary Surface Grinder

The magnetic chuck has been entirely redesigned. Its diameter has been increased from 12 to 14½ in., its top-plate has been arranged so that it can be replaced when worn, and only a single coil is used for energizing purposes. This distributes the flux equally and minimizes electrical trouble.

This grinder is made in three sizes, 8, 12, and 16 inches. Three work feeds are provided, with three wheel feeds for each one. The chuck sliding bracket is raised or lowered by a handwheel, and has a tapered gib running its entire length to insure adjustment. The thrust of the elevating screw is taken by ball bearings.

The wheel feeds are both hand and automatic. Stroke adjustment is made by means of sliding dogs on the wheel rack slide. Screws on the pawls of these dogs provide exact adjustment. The wheel slide is very heavy, and the wheel spindle is belted to a countershaft. This construction permits the taking of heavy roughing cuts.

The machine is self-contained, the ball-bearing countershaft with its tight-and-loose pulleys being an integral part of the machine. When the grinder is arranged for motor-drive, the motor is mounted on a base at the rear of the machine. Drive is through a 3-in. chain to a sprocket on the countershaft.

The specifications of the 12 in. size are as follows: Actual diameter magnetic chuck, 12½ in.; largest diameter clear grind, 14½ in.; greatest swing inside water pan, 16½ in.; greatest swing without water pan, 24 in.; greatest distance between work table and wheel with full diameter wheel, 11 in.; tilt of work table, either direction, 12 deg.; size grinding wheel, 5-in. hole, 12 in. x 1 in.; approximate net weight, 2,800 lb.; floor space occupied, 61 x 41 inches.

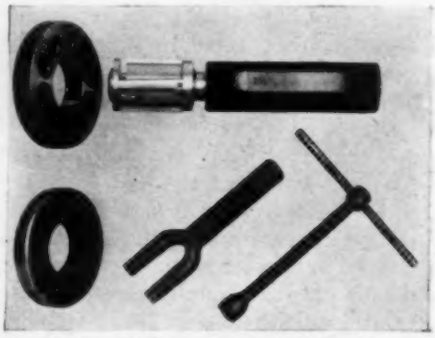
Strauss Tungsten-Carbide Cutting Metal

The Ludlum Steel Company, Watervliet, N. Y., is introducing Strauss Metal, a tungsten-carbide product for use in cutting tools. This product is offered as a result of co-ordinated investigation with the Krupp Research Laboratories, and, through license agreements, all the research and methods of the Carboloy Company have been placed at the disposal of the Ludlum Steel Company.

The metal is intended for application on saws, milling cutters, profile cutters, end mills, filing cutters, reamers and on drills used on hard and tough alloys where the runs are long or the cutting difficult. Advantages claimed for the metal are that it will speed the machining of many materials, will enable manufacturers to use harder materials or to do cutting jobs hitherto considered impossible, and will solve machining problems presented by abrasives. It is also claimed that the metal will increase production from two to ten times, increase the life of cutters two to fifteen times, and reduce frequency of grinding five to 70 times.

Bath Adjustable Plain Plug Gage

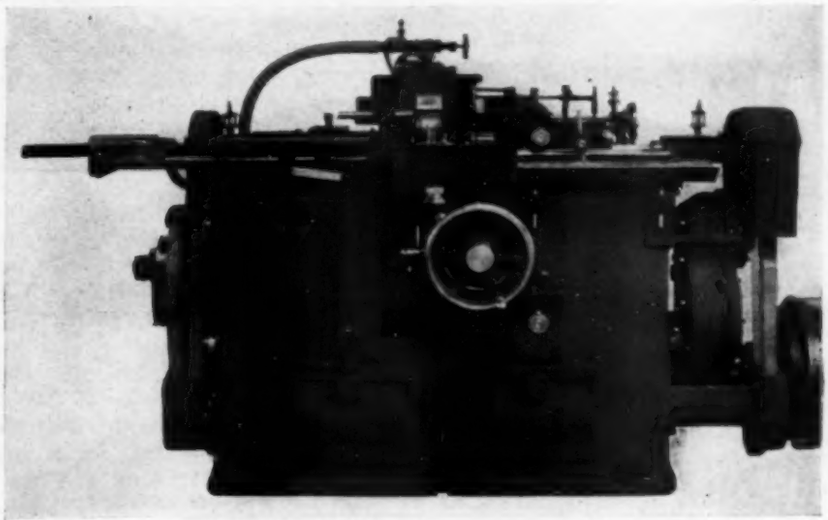
Equipped with four adjustable jaws to compensate for wear, an improved plain plug gage is being introduced by John Bath & Company, 18 Grafton St., Worcester, Mass. According to the manufacturer, the gage is applicable wherever a plain plug gage is used, but in addition has the adjustable feature which gives it greater service life. The gage is adjusted by means of a special wrench, which is used to turn an adjusting screw located in the handle. A master ring is also furnished as a reference standard for maintaining the gage at the proper size. Its accuracy is plus or minus 0.00005 in. The gage is obtainable in the standard sizes.



Bath Adjustable Plain Plug Gage, showing master ring and special wrench

Arter No. 132 Automatic Cylindrical Grinder

IMPROVEMENTS made in the No. 132 automatic cylindrical grinder, manufactured by the Arter Grinding Machine Company, Worcester, Mass., have been extensive. The wheel slide has been lengthened, the handwheel through which compensation is made for wheel wear, has been increased in diameter and provided with means for making adjustments in 0.0001-inch.



After No. 132 Automatic Cylindrical Grinder

Texrope-type belts are now used to drive the wheel spindle, and the wheel spindle bearing construction has been improved so that adjustments are more easily made and maintained.

The wheel dressing attachment is operated by a motor mounted on the machine, and has push button control with stop, start and reverse stations. A motor-driven grinder is provided for grinding the work centers while in position. The size of the coolant tank has also been increased.

This machine in its improved form is used to grind automatically, by the striaght-in feed method, straight or tapered diameters such as are presented in roller bearings, valve push-rods, valve-stem guides, pistons, and similar work that can be held on centering devices.

A turret is provided to convey the work to the centers. These turrets are split to facilitate changing. The number of holes in the turret for carrying the work are as numerous as the size of the work will permit, and sufficient clearance is provided so that the work will revolve freely on centers.

Work may be loaded into the turret by hand, or automatically, according to its nature. As the turret indexes to the grinding position the two live centers automatically pick up and drive the work. Frictional force created by spring pressure behind the tailstock center is the driving medium. The wheel then moves in and grinds the work to size. Successive indexing movements bring the work to a chute into which it is automatically discharged. The wheelhead travels on one V and one flat way and is automatically moved to and from the work by a cam-actuated mechanism.

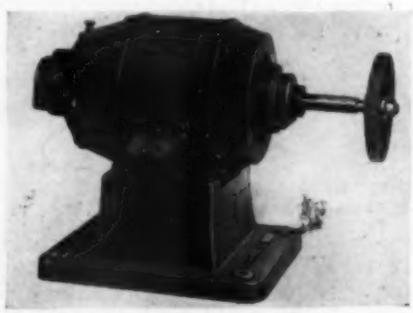
Continuous-feed lubrication is provided by a positive pump. The machine is self-contained, being designed for indirect motor-drive by belt, or by direct motor-drive through a flexible coupling.

All the equipment necessary for grinding work with the use of a coolant is provided. The tank of 55 gal. capacity, is located at the rear of the machine. The pump is of the submerged, centrifugal type with all bearings above the liquid. Particular attention has been given to the means for lubricating all moving parts, and adequate guards are provided.

The general specifications of the machine are: Work capacity, diameter, 5 in.; work capacity, length one grind, 5½ in.; maximum distance between centers, 16 in.; grinding wheel, 18 in. dia., 12 in. hole, width, as necessary for work; floor space occupied, 90 x 70 in.; net weight, 5800 lb., motor specifications, 10-25 hp., according to work.

Blount Tap Grinder

The J. G. Blount Company, Everett, Mass., will show a machine for tap grinding. This machine, driven by a specially-designed, 1¼-hp. Westinghouse type SK motor, is applied to the grinding of tap flutes by the use of a taper arbor on the end of a spindle, using various sizes of grinding wheels. The unit is self-contained, being driven by a direct-connected, totally-inclosed, ball-bearing-mounted motor with a speed range of 4,000 to 7,000 r.p.m., controlled by a field rheostat so that any grinding speed within that range may be obtained. The manufacturer claims that a smooth finish can be obtained because of the close speed regulation of the drive.



Blount Tap Grinder

Cleveland Tungsten-Carbide-Tipped Drills and Reamers

The Cleveland Twist Drill Company, Cleveland, Ohio, will exhibit twist drills and reamers with tungsten-carbide tips, as shown at Figs.

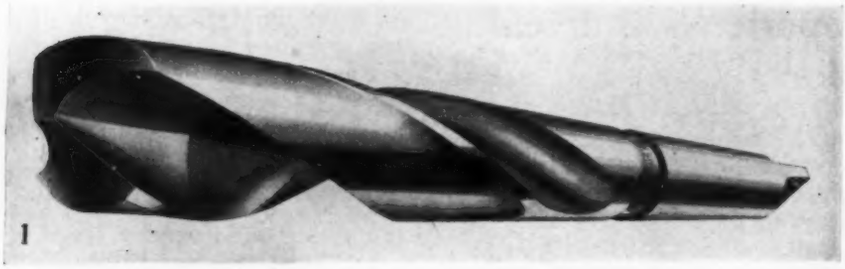


Fig. 1—Cleveland Twist Drill with tungsten-carbide tips brazed in place.

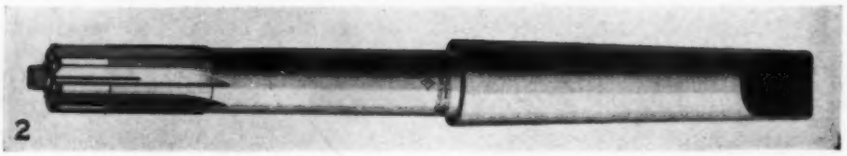


Fig. 2—Reamer of the same make with tungsten-carbide tips

1 and 2. The properties of the tungsten-carbide alloys are so different from the steels now used for cutting tools that it has been necessary to develop tools to utilize these materials to advantage. This has been done by brazing inserts of the hard metal alloys to a steel body. The use of drills and reamers with tungsten-carbide cutting edges is more experimental than is the case with lathe tools.

Lees-Bradner Oil-Well-Tool Threading and Turning Machine

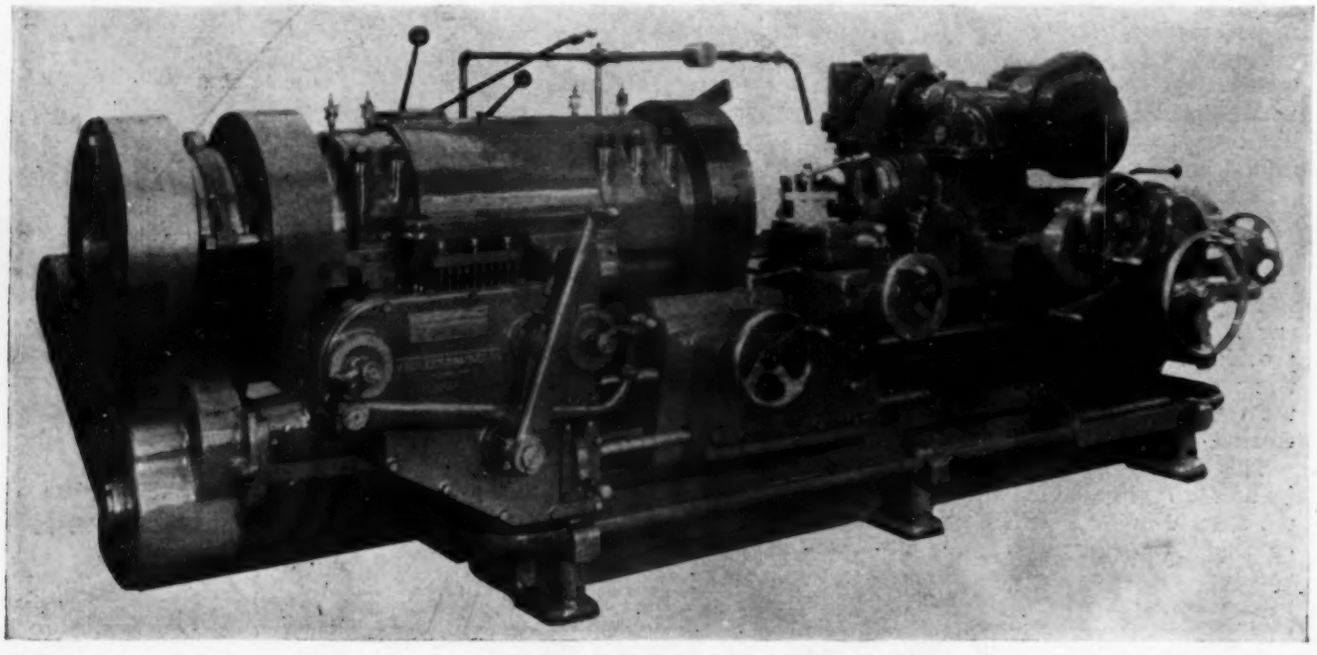
THE thread milling machine, shown in the accompanying illustration, has recently been introduced by The Lees-Bradner Company, Cleveland, Ohio. This machine was designed primarily for milling threads on oil-well drilling tools, tool joints, and drill pipe, and produces these threads in a little more than a revolution of the work.

In many instances, the nature of the work is such that faces and shoulders may be concentric with the threads being milled and that these facing and turning operations can be performed at the same chucking. The machine was, therefore, provided with a selective-speed headstock, apron, and cross-slide with square turret toolpost with selective power feeds for straight turning and facing operations. The headstock has a hollow work spindle for bar or tube work up to 10½ in. in diameter and may be provided with air or manually operated chucks, front and rear.

The cutter head unit is rigidly built to prevent vibration, and the cutter spindle is worm-wheel driven to insure a uniform flow of power, and journaled in ample bronze bearings provided with takeup for wear. This unit is provided with power quick approach and reversal.

The headstock and cutter head units are individually motor driven and provision in both is made, through pick-off gears, for a large range of thread milling and cutter speeds.

By means of a taper attachment, with which the machine is provided, either straight, taper, internal or external threads may be milled rapidly and accurately. This machine incorporates the Lees-Bradner method for eliminating backlash.



Lees-Bradner Oil-Well-Tool Threading and Turning Machine

Sellers No. 1 Hob and Cutter Grinder

THE No. 1 hob and cutter grinder, just announced by William Sellers & Company, Philadelphia, is designed to sharpen straight and spiral hobs, milling cutters, reamers, taps, etc. It will grind work 12 in. in diameter and 12 in. long and is quickly and easily set. All feeds and indexing are automatic and their setting is facilitated by micrometers.

Indexing gears are eliminated to do away with back lash and lost motion, thus making it possible to grind on both the cutting and return strokes. Spiral leads to be ground on hobs or cutters are controlled by a sine bar generating the exact right or left hand helix.

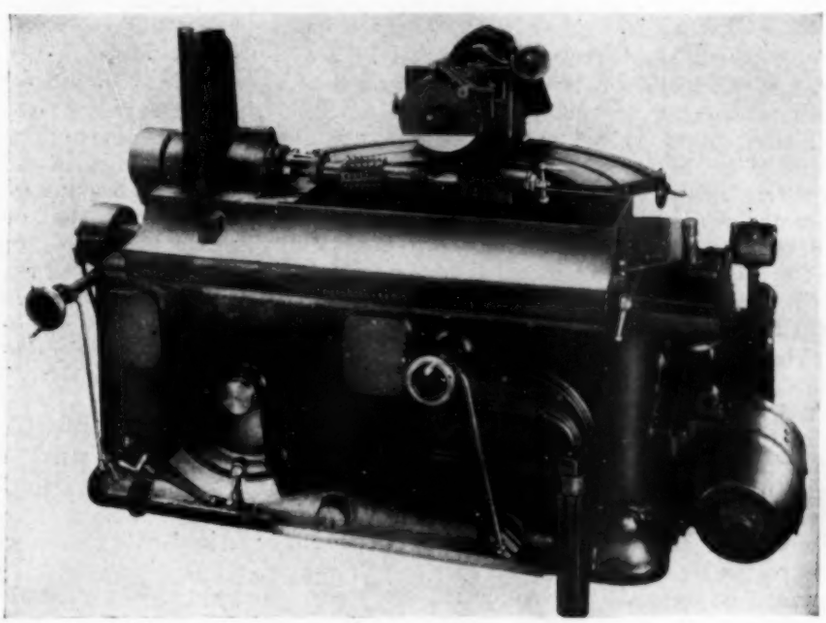
The carriage is of strong construction with the bottom plate made in two pieces so that one end may be raised to permit grinding work. It is carried on one Vee and one flat way on the heavy bed and is driven through a crank and elliptical gear. This mechanism allows the speed during the cut to be uniform, and for an increased speed on the reversal. The length of stroke may be varied to suit the work and there are also two speeds at which the carriage may be run.

The 10-in. saucer-type wheel, driven by independent motor, is located above the work and is carried on a series of slides attached to the main bed. The wheel spindle is mounted in ball bearings and, to insure accuracy, these bearings are made to compensate for expansion caused by heating so that the position of the wheel, while at work, will not be affected. The up-and-down adjustment of the grinding wheel is made along a slide on the back of the bed which is inclined at the same angle as the face of the wheel. Such being the case, when the wheel is set at the center of the axis of the work, any vertical motion will carry the wheel radially. The grinding head can also swivel 45 deg. on either side to accommodate helical work. It can be moved in and out so that any angle of clearance can be obtained, as well as compensation for wheel wear.

The automatic feed includes the vertical feed as well as feeding into the wheel in a circular direction. The machine is arranged for motor drive only and requires two 1-hp. constant-speed motors. One motor, directly connected to the spindle, is carried on the grinding head slide. The other motor, mounted on the right hand end of the bed, operates the carriage driving mechanism as well as the feed and indexing mechanism. As the motors are constant speed they can be of either the a.c. or d.c. type.

The machine has a central lubrication system operating by gravity. The oil is filtered and a pump connected with the main driving motor forces it to the reservoir located above the bearings.

The machine can be used for either wet or dry grinding. The table and bed are designed to collect water and return it to a settling basin. A centrifugal pump connected to the drive supplies water from the settling basin through a flexible hose to the point of grind. One operator can run five or six machines.



Sellers No. 1 Hob and Cutter Grinder

Buffalo 14-Inch Sliding-Head Drill

A 14-in. sliding head drill has just been announced by the Buffalo Forge Company, Buffalo, N. Y. This machine comes in both bench and pedestal types.

The machine will drill to the center

Buffalo 14-Inch Sliding-Head Drill

of 14 in. Specifications for the two types are: Distance from column to center of spindle, $7\frac{1}{8}$ in.; travel of spindle, $3\frac{1}{2}$ in.; largest drill used, $1\frac{7}{16}$ in.; maximum speed, 10,000 r.p.m.; drive pulley speed 1,800 r.p.m.; four spindle-speeds, 9,200,

6,900, 4,000 and 3,000 r.p.m.; chuck capacity, $\frac{3}{8}$ in.; diameter of spindle, $\frac{5}{8}$ in.; power required, $\frac{1}{2}$ horsepower.

Other specifications for the bench-type machine are: Maximum distance, chuck to table, 11 in.; working surface of table, 14x14 in.; size of table, 19x22½ in.; total height, 44 in.; net weight, approximately 260 lb. For the pedestal-type machine the specifications are: Maximum distance from chuck to table, 30 in.; working surface of table, 18x14 in.; size of table, 22x19 in.; floor space 20x26 in.; total height, 81 in.; net weight, approximately 500 pounds.

"Footburt" No. 16 Hydraulic- and Mechanical-Feed Drilling Machines

TWO vertical multiple-spindle drilling machines, one with mechanical feed and the other with hydraulic feed, have been placed on the market by the Foote-Burt Company, Cleveland, Ohio. The mechanical type has 16-in. ways, and the hydraulic type, 20-in. ways, and both have the same drilling capacity, but the hydraulic unit has a wider column and ways to accommodate the cylinder. Both types are adaptable to many kinds of work, but each machine is built around the particular job for which it is designed, so as to obtain the greatest efficiency.

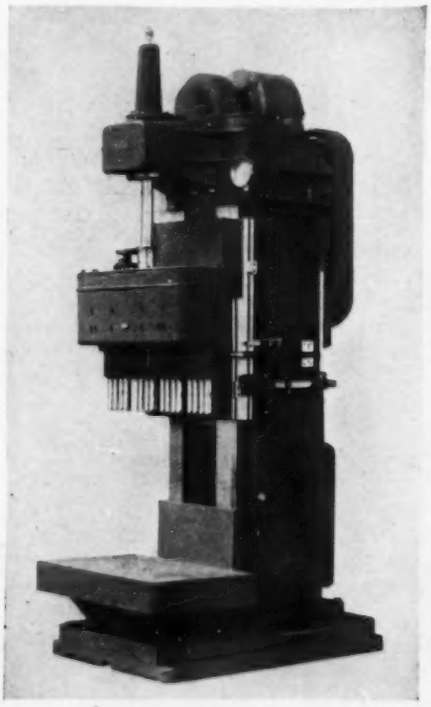
Both machines have a standard base, upright and drive brackets, but the table, head, drive and feed and speed arrangements are varied to suit the work. The column and base are separate castings bolted together. The standard table, as shown in the illustration, is designed to slide on the ways of the upright, but is usually held in one position by spacer blocks between it and the base.

Heads are individually designed with special gearing to secure the correct speeds and locations of the spindles. All spindles have ball thrust bearings and can be equipped with adjustable collets, so that vertical adjustment can be made on individual spindles. Lubrication of the head is by means of a forced-feed oiling system, oil being carried to the head and then circulated by a pump mounted on the head itself and driven by a belt from the head drive shaft.

Feed for the No. 16 mechanical is taken from the main horizontal shaft in the upper drive housing through a pair of small pulleys to a worm and worm gear set. It is then carried through the vertical feed shaft to a large worm and worm gear set mounted on the feed pinion shaft. The pinion meshes with a steel rack mounted on the slide. The standard length of travel is 16 inches. Fast traverse in either direction by hand is by means of handles, located usually at the left-hand side of the machine.

The No. 16 hydraulic is usually equipped with an oilgear type QM pump and a 5⅛-in. cylinder with 16-in. stroke. This is considered standard, but other sizes may be furnished with the above equipment. The following feeds are available Fast traverse forward, 175 in. per min. No. 1 slow feed forward, 1 in. to 13 in. per min.; No. 2 slow feed forward, 1 in. to 13 in. per min.; No. 1 slow feed return, 1 in. to 13 in. per min.; No. 2 slow feed return, 1 in. to 13 in. per min.; fast traverse return, 250 in. per min., and neutral.

These two forward feeds and two reverse feeds make this machine adaptable to almost any operation with combination tools or indexing tables. The feed is engaged by a hand lever on the side of the machine and feeds are controlled automatically throughout the cycle by dogs located on the head slide. Delayed reverse action can be obtained if desired. The hydraulic cylinder is installed in the column by bolting it to a heavy steel flange that covers the entire top of the column. The flange is in turn bolted to the column, making a rigid support. The cylinder tierods and all connections for the hydraulic equipment are easily accessible without disturbing the rest of the machine.



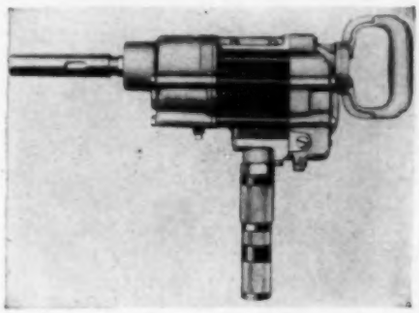
"Footburt" No. 16 Drilling machine which is available in mechanical- and hydraulic-feed types

SPECIFICATIONS

	No. 16 Mechanical	No. 16 Oilgear
Width of ways	16 in.	20 in.
Length of slide	40 in.	40 in.
Bottom of slide to base	48¼ in.	45 in.
Slide travel	16 in.	16 in.
Dis. finish of ways to finish of slide	3 in.	3 in.
Width of slide	20¼ in.	24½ in.
Dis. drive shaft to ways	10 in.	13½ in.
Base to drive bracket, head room	89¾ in.	89½ in.
Height of table to floor, min. (fixed)	19¼ in.	19¼ in.
Working surface of table (fixed)	25x40 in.	25x40 in.
Approx. height of machine, motor drive	123 in.	127 in.

Rotor Types E-4-C and E-40-C Production Drills

The Rotor Air Tool Company, Cleveland, Ohio, has put on the market types E-4-C and E-40-C drills, in ¼-, ⅜-, ½-, and 1-in. sizes. These



Rotor Type E-4-C Production Drill

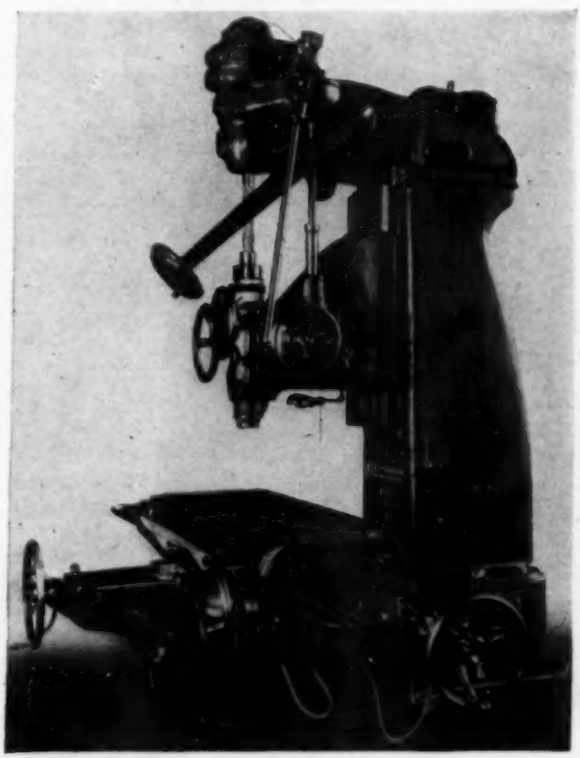
drills are compound-geared for production drilling, reaming, stud setting, and nut setting. They are built for hard usage and are compact. Compound gears of heat-treated, nickel-alloy steel are used for high power and torque. Extra-heavy ball bearings are provided.

The quick-acting governor prevents racing of the motor while running free, thus giving the spindle a uniform speed, preventing excessive wear, and reducing the air consumption.

Drills are furnished with side handle and with the usual optional equipment of breastplate, spade-handle, eye-bolt, and similar parts. The E-40-C differs from the E-4-C in having a longer cylinder and hence gives more power. Speeds ranging from 200 to 600 r.p.m. are provided covering drilling from 1 in. to $\frac{1}{2}$ in., reaming from $\frac{11}{16}$ to $\frac{3}{8}$ in., tapping $\frac{3}{4}$ to $\frac{5}{8}$ in. The E-4-C weighs 16 lb., and the E-40-C, 17 pounds.

Pratt & Whitney Nos. 3 and 3A Jig Boring Machines

THE Pratt & Whitney Company, Hartford, Conn., is now building the large jig borer shown in the illustration. It embodies the same fundamental system of locating and using end measures, inside micrometers and dial indicators, as other Pratt & Whitney machines of its class. It has the same features of locating to tenths, boring where it locates, and then checking its own work to tenths without changing the work setup. As with the smaller machines, the operator has visible assurance that his work is accurate at all times.



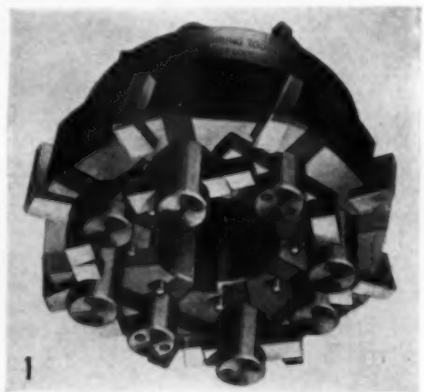
Pratt & Whitney No. 3 Jig Boring Machine

Machines are made only in motor-drive. Several improvements have been added, such as lights over each dial indicator and above the work. A switch connected to the spindle clutch lever starts and stops the drive motor as the clutch is operated. The motor itself has four speeds which means eight spindle speeds with the back gears.

The main dimensions of the No. 3 machine are: Table working surface, 24x48 in.; table travel, 42 in. longitudinal and 24 in. traverse; table top to spindle end, 4 to 30 in.; head travel, 17 in.; quill travel, 9 in.; spindle center to column, 22 in. The 3A machine has a 24x60-in. table with a long travel of 54 in., other dimensions being the same as on the No. 3 machine. Spindle speeds are 40 to 525 r.p.m.; feeds, 0.0025 to 0.010 in. per rev. The No. 3 weighs 15,000 lb., and the No. 3A 15,500 pounds.

Gairing Swing-Tool Boring Head

The swing-tool boring head, of which two views are shown in the illustrations, is manufactured by The Gairing Tool Company, Detroit, Mich. The tool consists essentially



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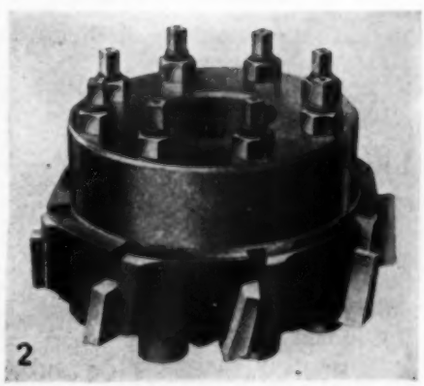

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Fig. 1—Showing the method of holding the tool bits in the Gairing Swing-Tool Boring Head. Fig. 2—By slacking off the nuts, the tool bits can be swung out or into the cutting position

of several toolbits held in round drawbars that fit snugly in the toolhead. The bottom of the toolhead has radial recesses, into which the toolbits fit while cutting, and which preserve accuracy of alignment. The body of the drawbar back of the head is reduced in size, and is centered by two bushings. The extreme back end of

the bar is squared, and adjacent to this is a threaded portion with a nut that draws the toolbit down into the recess and holds it while cutting.

The toolbits may be ground so that a certain number of them cut one diameter while the rest are swung out of action. This feature allows of boring on either the forward or return stroke, or both. It also permits of cutting a large diameter, then a smaller one, and passing through the work cut a larger one on the other end.

This arrangement also relieves the operator of responsibility for accuracy, as the tools are ground in position before being swung out of position. They are held in the head by the hollow setscrews shown at the large end of the drawbar.

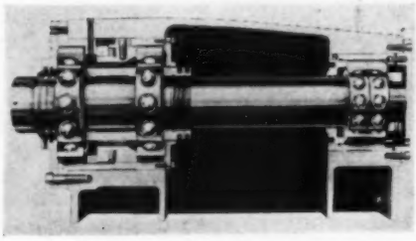
The replacement of tools is simple, and they can be set with the boring bar and a micrometer. The operation of swinging a tool out of position is equally simple. When the nut on the opposite end of the drawbar is loosened, a spring under the head lifts the toolbit clear of the radial recess. A wrench on the squared end turns and holds it until the nut is again tightened.

The head is fastened to and driven by a bar having a key. The hole in the head that carries the bar is ground with two radii, one is exactly the same as the boring bar that fits into the hole, and the other radius is 0.01 in. oversize. The key way is opposite the center of the smaller radius and the two setscrews press the bar firmly into it, thus securing a combination of accuracy and a loose fit.

The reduction in machining time claimed for this type of tool over ordinary machining methods is substantial, and its field of usefulness covers not only conventional operations, but special castings and parts such as dual locomotive valve chambers, intricate compression cyliders, and similar work.

New Departure Double-Row Ball Bearings and Applications

Double-row ball bearings for application to machine tool equipment have been developed by The New Departure Manufacturing Company, Bristol, Conn. The bearings are of especially rigid design, particularly adapted to give non-deflecting support under radial and thrust loads. With the design shown in the illustration it is possible to mount the bearings and preload them upon the bench. The spindle and bearing assembly may then be mounted in the machine as a unit. The spindle housings in the machine frame are bored straight through without shoulders so that the spindle unit may be introduced from one end with a minimum of time and trouble.



New Departure Double-Row Ball Bearings mounted on a double-duty spindle

These bearings are also applied to tailstock live-centers. They are preloaded internally in these centers at assembly and when the latter are placed in the machine, with the housing closure on the side away from the work, where there is least possibility of entrance by chips and cutting compound, the bearings are capable of continuous operation without adjustment or lubrication by the operator.

Kearney & Trecker Bridge-Type Vertical "Mil-Waukee-Mil"

A VERTICAL "Mil-Waukee-Mil" of the bridge type has just been introduced by the Kearney & Trecker Corporation, Milwaukee, Wis. It is designed to do face milling, die-sinking, routing, profile milling, jig and fixture work, and other jobs usually routed to a heavy-duty, vertical, knee-type machine. A front right-hand-quarter view is shown in Fig. 1, below.

The bridge or rail can be raised or

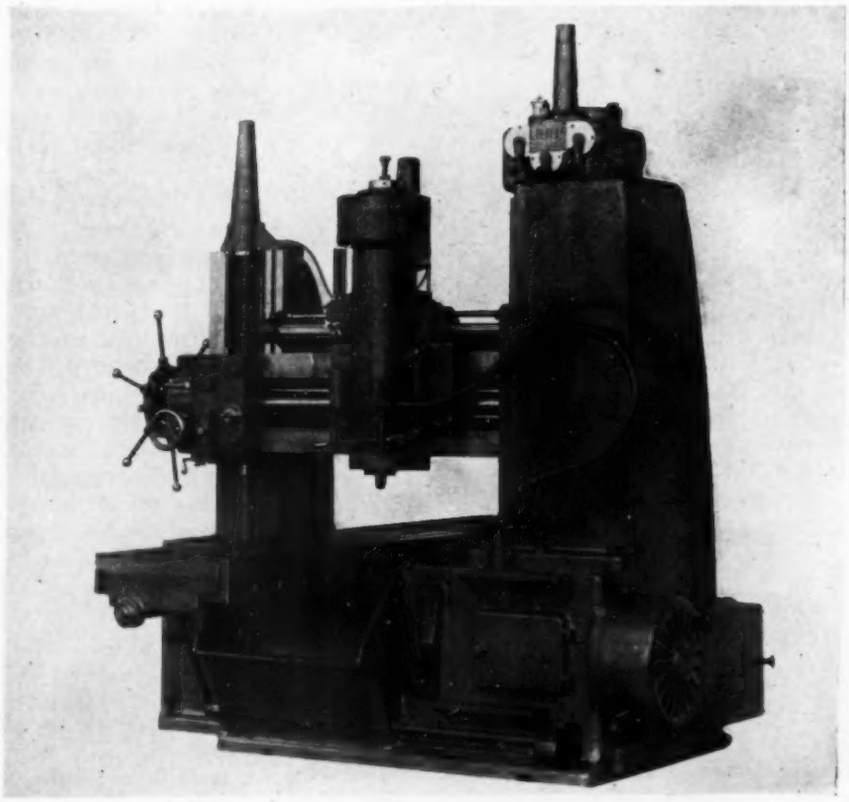


Fig. 1—Front right-hand-quarter view of the Bridge-Type Vertical "Mil-Waukee-Mil"

lowered by power at the rate of 25 in. per min. and locked in position. The saddle carrying the vertical ram and spindle can be traversed a distance of 24 in. either in or out across the table, by power feed or by power rapid traverse—in either direction.

The spindle ram is provided with 7 in. of power down feed, or it can be run up and down with either slow or quick hand movement, the slow movement being graduated in thousandths. There can be furnished four-position micrometer stops for the vertical ram movement. The machine illustrated is equipped with this extra feature.

A standard Mil-Waukee-Mil Simplex bed is used. The table is 22 in. wide and can be furnished in any length of table feed from 3 ft. to 11 ft. The maximum width of work that will pass through the housings is 46 inches.

Usual Controls

The bridge, saddle, and spindle movements are controlled by the same levers by which any normal Mil-Waukee-Mil is controlled at the front of the bed, as shown in Fig. 2. The long vertical lever to the right starts and stops the spindle. The lower of the two shorter levers controls the rate of travel, either feed or rapid traverse. The levers for engaging the feed movements after the rate of travel has been determined are located on the gearbox on the bridge.

The bridge is fitted to an upright housing similar to the corresponding part on the regular Mil-Waukee-Mil Vertical, but much heavier in construction. The heavy upright housing is bolted to the bed and has no adjustment. The bridge fits into ways on this upright. There is a secondary upright housing bolted to the front of the bed to carry the front end of the bridge.

The bridge is raised and lowered by means of two screws, one at each end, and geared together to preserve alignment. Provision is made in the outer upright so that the nut of the outer screw can be independently adjusted for precision leveling of the bridge. It can only be operated by power. The horizontal lever at the front of the gearbox on the outer end of the bridge controls this movement. The total movement is 17 in. It can be lowered to a minimum distance of 11 in. from the underside of the bridge to the top of the table, or raised to a maximum distance of 28 in. Safety trips are provided at both the upper and lower limits of travel.

The rate of power rapid traverse of the saddle along the bridge is fixed at 100 in. per minute. The power feed for the saddle is driven from the standard feed box and is the same at all settings as the table feed, so that the cutter mark on the work will always be the same regardless of whether the table feed or the saddle cross feed is engaged. It is possible to engage both the saddle cross feed and the milling machine table feed at the same time for diagonal milling. There are trip dogs to stop the feed or power rapid traverse of the saddle at any desired point along the bridge.

The feed may be either with pick-off gears or quick-change gearbox, and with a range of either ½ to 20 in. per min. or 1 to 40 in. per min., the same as on all other Mil-Waukee-Mils. Unless otherwise specified, the machine will be furnished with a range of 1 to 40 in. per minute.

The spindle ram is fitted to vertical ways on the saddle which, in turn, is fitted to horizontal ways on the bridge. The horizontal lever that extends across in front of the ram is for locking the gib in the saddle after vertical adjustment of the ram has been completed. As mentioned at the outset, the vertical ram has 7 in. of power down feed. The upward return is by hand movement.

The engagement of the power down feed to the spindle ram is by means of the horizontal lever located at the bottom of the gear box at the outer end of the bridge. The power down feed rates for the ram are one-fourth of the feed rates shown on the feed plate of the milling machine. This provides the fine feeds necessary for boring operations.

The spindle ram is also provided with counter-balanced vertical adjustment for both slow and quick hand movement. The quick hand movement is accomplished with the large six-spoke pilot wheel at the outer end of the bridge. The slow hand movement is accomplished with the small handwheel at the lower left front of the gearbox. This movement is through a worm and wormwheel. The small three-spoke pilot wheel at the extreme outer end of the bridge controls the clutch on the wormwheel.

The ring of the large six-spoke pilot wheel at the end of the bridge

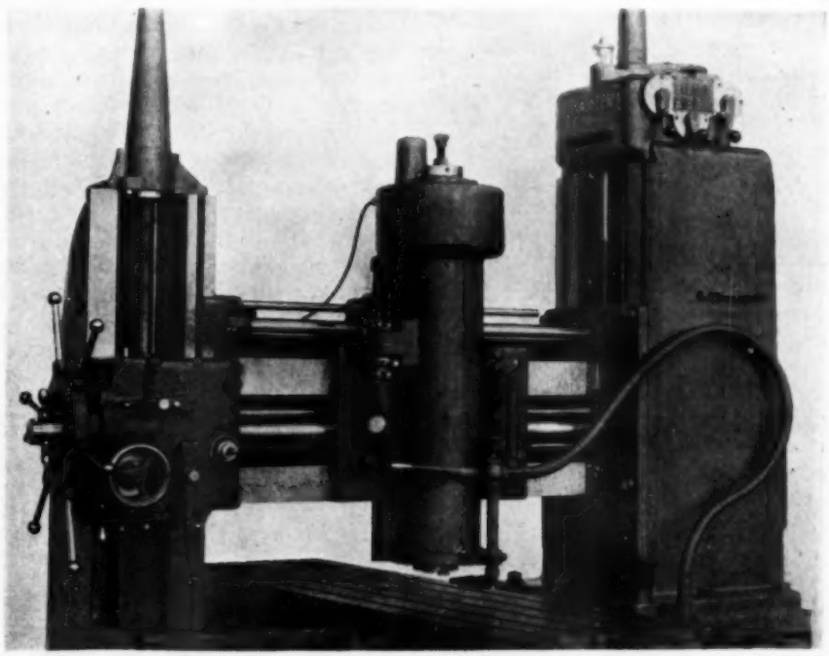


Fig. 2—Close view of bridge and control mechanism

has a T-slot which carries an adjustable dog to disengage the power down feed of the ram at any predetermined point. This hub ring also carries a fixed limit stop.

The spindle ram can be lowered or fed down to a minimum distance of 3¼ in. from the end of the spindle to the top of the table, or raised to a maximum distance of 26¼ inches.

The spindle drive is through the standard speed box at the top of the main upright, the same as on all other Mil-Waukee-Mils, and may be either through pick-off gears or quick-change gearbox. With pick-off gears, the spindle speeds may be selected, 15 to 150, or 20 to 200, or 30 to 300, or 50 to 500. Unless otherwise specified, machines will be furnished with the lower speed range of 15 to 150 r.p.m. With quick-change speed box, the speeds provided for are 15 to 300, in eighteen changes. By shifting a pair of change gears in the speed box, a second series of eighteen speeds are available from 30 to 600 rev. per minute.

Bridge Locking Mechanisms

The bridge can be securely locked to both uprights. The saddle can be locked to the bridge, and, as a further facility for accurate boring, a lock has been provided for the milling machine table. Thus, during boring operations, the only movable part is the spindle.

From the drive pulley to the spindle nose, there is not a plain bearing. The spindle and its drive throughout its entirety rolls on anti-friction bearings. Lubrication of all bearings is automatic.

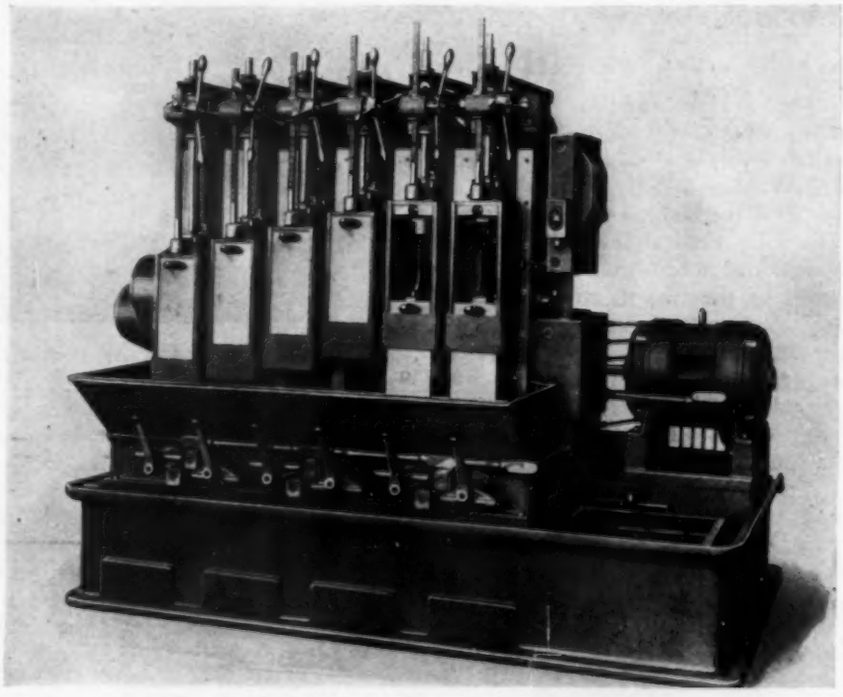
The spindle ram can be furnished with a four-position micrometer stop and indicator dial, as shown in the photographs, at the left side of the ram. The short handle that projects out horizontally near the bottom of the four screws controls a ratchet device by which any one of the four screws can be rotated into position over the anvil. This is a very desirable feature on production run jobs where there are three or four surfaces at different heights to be milled on each casting. The individual stop screws need be set but once and the correct depths of cut will always be maintained without any difficulty.

Pratt & Whitney Six-Spindle, Vertical, Deep-Hole Driller

THE six-spindle vertical deep-hole driller shown in the illustration is manufactured by the Pratt & Whitney Company, Hartford, Conn. It uses the well known rifle-barrel method of drilling. This principle has been combined with modern production methods of convenient work handling, and with the recent developments in cutting alloys for rapidly removing metal. The six-spindle vertical deep-hole driller consists of a heavy cast-iron bed, on which is mounted a rigid column. This column carries the six work-spindle slides together with their individual drive mechanism. The six drills remain stationary, and are mounted vertically on the bed beneath the spindles. The work-holding mechanism used varies according to the work being drilled. The spindles rotate the work in the fixture at the correct drilling speeds. The speed depending upon the nature of the work and is regulated by the speed of the individual spindle driving motor and by the diameters of the pulleys used. By this arrangement the six work-slides feed down independently under power, and carry the rotating work to the stationary drills. Thus there are six independent machines, each operating without relation to the others, at the will of the operator. On the rear of the bed is the pump-drive compartment containing the six high-pressure oil pumps, one for each drill, and the large motor which drives all six pumps through gearing.

Two bearings are mounted on the upper part of the spindle, two more on the upper work holding fixture, which is attached to the spindle, and the fifth and sixth bearing are a part of the lower work holding fixture. This arrangement makes it possible to run the six spindles at a continuously high rate of speed.

The drill used, is of special design and consists of a hollow shank to which is brazed a short, high-speed-steel drill tip. The shank is made as long as required, with a groove pressed into one side so that oil can be forced through the inside to the drill tip under high pressure and returned outside through the groove.



Pratt & Whitney Six-Spindle, Vertical, Deep-Hole Driller

The drill tip is made with a hole through it corresponding to the inside of the shank, and a groove is cut in its side which lines up with a groove in the shank. The tip is ground to a special form that will cut a clean true hole, and deliver the chips well broken up so they will flow out easily with the oil.

Chips Blown Away

Oil under pressure of 500 lb. or more is delivered to the inside of the drill shank. This oil actually blows all chips out of the way instantly so there is no possibility of a chip jamming the drill tip and forcing it out of line. This method produces a smooth accurate hole, straight within very close limits, and with an excellent finish. In gun work the drilling operation is followed by special reamers, but this is only necessary when exceptional accuracy and finish is needed.

The drills used are economical, as the shank is inexpensive and sustains all twisting damage should the drill meet a hard spot or become jammed. The more expensive tip can be rebrazed to a new shank and reground as necessary, until it is used up.

The pump-drive compartment located at the rear of the bed is arranged to supply all the cutting oil required for drilling. Six P & W Model 2-C high-pressure pumps are used, each capable of delivering a pressure of 500 lb. per sq.in. One pump supplies each spindle, so that pressure can be built up in case chips become clogged in the drill. All the pumps are geared to a single driveshaft directly connected to a 15-hp. motor. This motor is for the operation of the pumps only.

The oil reservoir located in the bed of the machine has a number of baffle compartments through which the oil must pass before going into the fine-mesh, easily-cleanable strainer. The inlet pipes leading to the pumps are all equipped with strainers, as well. This series of cleansing operations leaves the oil free of chips so that it can be used over and over again for a greater length of time.

A large portion of the machine is lubricated by the "single shot" system using a small hand oil-pump. Other portions of the machine have centralized gravity lubrication from large glass oilers. In a few instances, such as on the slides, individual oilers are used. The entire lubrication of this large machine is a simple matter, requiring only a few minutes a day.

The operation of the machine is intended to proceed in a progressive manner. In starting, one spindle is loaded and the feed engaged to start drilling before the operator loads the next spindle. By so doing, five spindles will be in operation at all times while the sixth spindle is being unloaded and loaded.

Each spindle assembly is self-contained and its motor can be started or stopped independently, without delaying the work of the remaining spindles. By means of electrical connections it is impossible to start the spindle motors before starting the pump motor. This safeguards the machine because the drills cannot be started without cutting oil being available.

A power knock-off is provided at the butt end of each drill, which automatically stops the spindle motor, the feed and the oil after the drilling operation is completed. At this point the operator raises the spindle to the normal starting position by using the capstan handle. A little additional pressure on this handle will clear the lower holding fixture from the work. By loosening a set screw in the upper holding fixture the drilled piece can be removed quickly and another piece inserted ready for drilling. An adjustable indicator rod is attached to each spindle housing so that the operator can approximate the depth of the hole being drilled at any time.

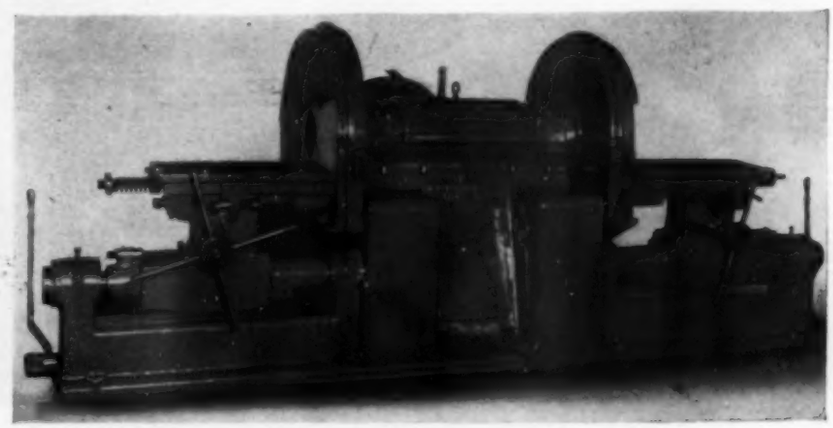
The friction knock-off of any spindle will function automatically should the drill tend to revolve from sticking or clogging in the hole, or striking a hard spot. This friction knock-off also will come into operation if the drill becomes too dull to work at the correct rate of speed for the work being drilled.

Gardner No. 9, 40-Inch "Super Disc" Grinder

THIS machine, made by the Gardner Machine Company, Beloit, Wis., has two 40-in. steel wheels faced with heavy-type Gardner G.I.A. disks, each rigidly supported by a 29-in. wheel flange mounted on a spindle $5\frac{7}{8}$ in. in diameter at the bearings. The spindle is carried in huge Timken bearings, and is driven by spiral bevel gears totally enclosed in a grease-tight housing. The machine operates semi-automatically, eliminating much manual labor.

The unit is powered either by belt, or by a direct-connected motor of from 25 to 40 hp., depending upon the nature of the work to be ground. Its two work tables are adjustably supported on a reinforced box section cast-iron shaft, $3\frac{1}{2}$ in. in diameter at its ends, with sturdy outboard bearing housings supported on the floor for their full length. Mechanical means are provided for rocking the tables automatically. Each may be operated independently of the other, or both simultaneously.

Oscillation of the work tables is



Gardner No. 9, 40-Inch "Super-Disc" Grinder for Heavy Work

quickly regulated by conveniently located hand- and foot-levers, and the work is fed into the cutting member by spring tension. On many jobs, therefore, one operator can serve both ends of the machine, loading one table while the other is presenting its work to the abrasive wheel. The entire unit is massive in construction, weighing approximately 16,000 pounds.

Norton Model 84, 17 x 30- to 17 x 36-Inch, Double-Head, Hydraulic Crankpin Grinding Machines

THE Norton Company, Worcester, Mass., has developed a machine designed with considerations for safety and a minimum of effort. Hydraulic control of work holders, table and wheel-slide traverse are interlocking, so that one cannot be moved while either of the others is in operation, insuring safety to both operator and the work.

Steadyrests a Feature

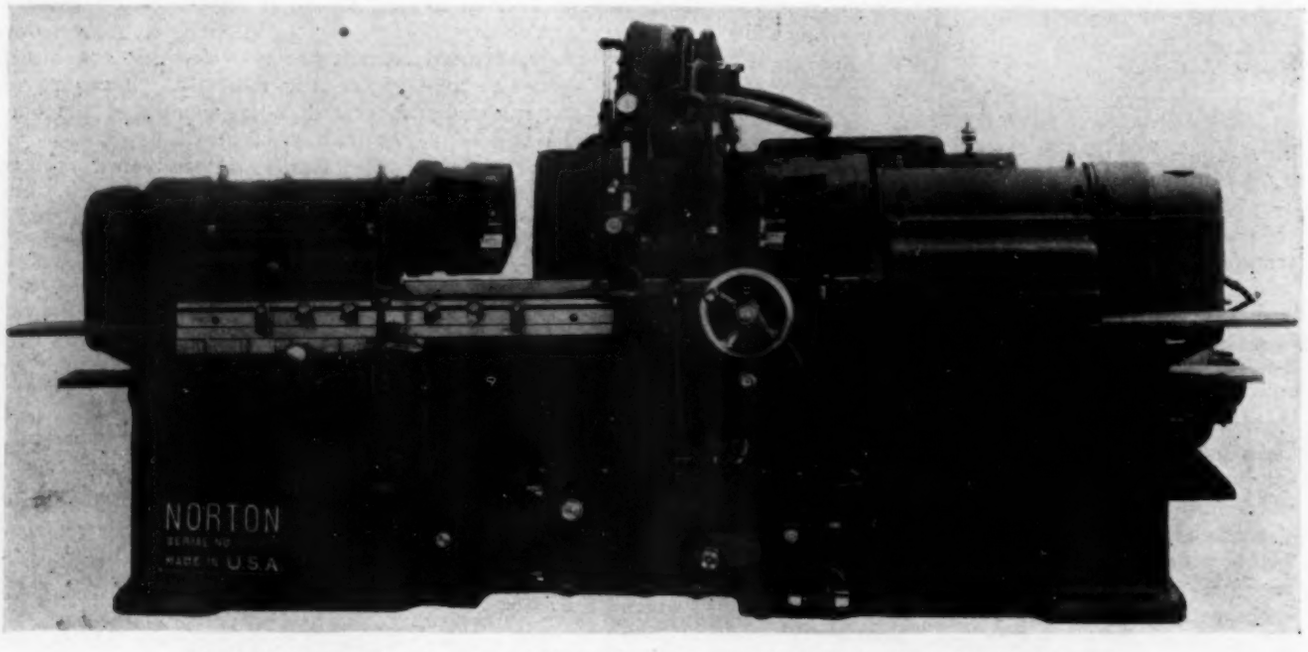
Mechanically operated steadyrests are a feature of the machine. When unclamped from the table the steadyrest moves upward permitting easy access to the work. The upward motion of the steadyrest also stops the flow of lubricant, though this may be renewed if desired by a manual control. Attached to the steadyrest are splash guards and a Pratt gage, which also move in and out of operating position with the steadyrest. This permits easy operation and obviates the necessity of lifting the work over the steadyrest. To still further reduce fatigue in reaching to place the work in the machine, the machine base has been designed so that the work is supported much closer to the operator and somewhat lower than the usual position. Because of these features, heavier crankshafts can be handled in and out of the machine without the employment of overhead hoisting devices.

The work holder spindles on the machine are synchronized and driven by two silent chains controlled by idler sprockets. The right-hand workhead is stationary and the left is provided with a lateral adjustment to permit maintenance of the proper alignment of the crankshaft. Hydraulically-operated clamps grip the work firmly. Failure of the hydraulic mechanism does not release the clamps. Locators on the work holders control the angular and endwise location of the pins in relation to a prescribed indexing position on the crankshaft that is being machined.

A spacing bar and dogs, with positioning slots, locate the lengthwise position of the work table for grinding each pin, and the machine may be set for a crankshaft with four, six or eight crankpins. Slow movement of the table is also provided for truing the grinding wheel. Four adjustments are provided on the wheel slide, fast motion to the shoulder of the pin, controllable feed down the shoulder to the body, fast return to the extreme rear position of the slide, and slow motion in both directions for truing to size the sides of the wheel to the correct width or thickness. Hand-feed is employed while the machine is utilized for grinding to size.

Controls Are Centered

Controls are centered at each side of the operator's position and are easily accessible. The machine is rigidly constructed and is entirely self-contained, a single motor mounted on the side of the rear base furnishing the motive power. It has a swing of 17 in. in diameter and is made in the following sizes: 24 to 30 in., 30 to 36 in., 36 to 42 in., 42 to 48 in., 48 to 54 in., and 54 to 60-in.



Norton Model 84, 17 x 30- to 17 x 36-Inch, Double-Head, Hydraulic Crankpin Grinding Machine

Gould & Eberhardt No. 9-H Universal And Nos. 48-HS and 48-HL Gear Hobbing Machines

TWO heavy manufacturing gear hobbing machines, Nos. 48-HS and 48-HL, for spur and slight angle helical gears, and a No. 9-H small high-speed universal gear hobbing machine designed for fine pitch and small diameter gears, have been brought out by Gould & Eberhardt, Newark (Irvington), N. J. The two heavy machines are additions to the company's present line of HS manufacturing hobbing machines.

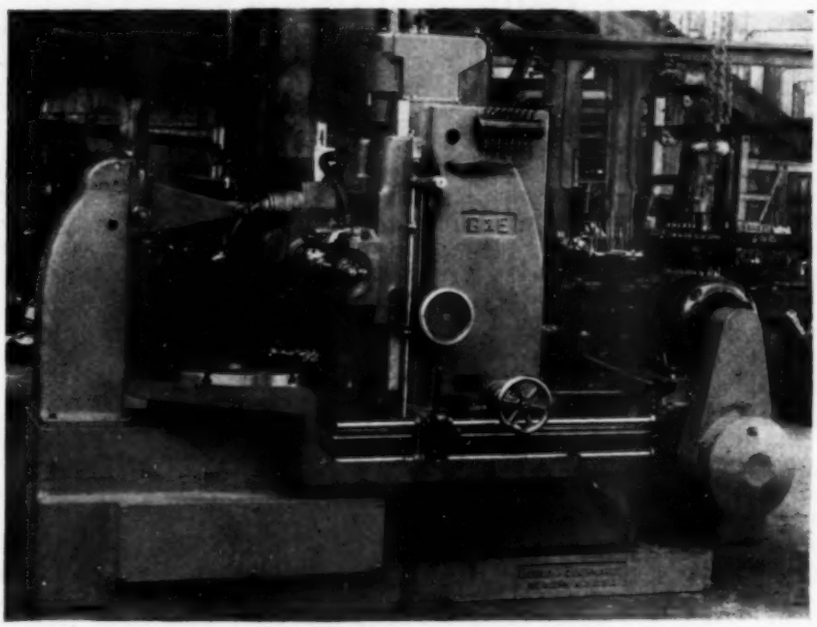


Fig. 1—Gould & Eberhardt No. 48-HL Gear Hobbing Machine

The heavy 48-HS and 48-HL machines are adapted for roughing and finishing large diameters and medium pitch spur gears, limited-angle helical gears, and sprockets and worm wheels used in tractors, railway cars, trucks, printing presses, and mining and hoisting equipment. Rated for 2 D.P. in steel, the machines have a capacity up to 32 in. in diameter with the arbor support and 57 in. in diameter with support removed. The weight of the machines is approximately 14,000 lb. each.

Characteristic of the manufacturing-type hobbing machines, the cutter and work drives of the 48-HS and 48-HL are balanced in this case with eight gears in each train from a common source terminating in a worm and wormwheel. Power rapid transverse at 50 in. per min. moves the cutter rapidly in either direction, and may be operated when the work and cutter spindles are idle or rotating. The traverse and feed controls are interlocked, so that one cannot be set in motion until the other is disconnected. An adjustable cam to stop the rapid approach and a safety pin prevent accidental downward operation of the power traverse.

The cycle of the cutter movement comprises three phases: Rapid approach, feed, and rapid reverse, each automatically arrested at a predetermined point. The feed motion automatically disengages the main clutch and stops the machine but leaves the power traverse available. Adjustable stops govern the movement of feed and traverse, and fixed safety stops control the extreme limits of motion. The cutter slide is mounted on a rigid box section stanchion and travels on double rectangular guides provided with independent adjustments. The stanchion is adjustable along the bed for depth of tooth and diameter of gear to be cut. A 10-deg. angular adjustment of the cutter slide is provided for single-, double-, or triple-thread hobs.

The work table is located in a large tapered bearing directly within the base casting. The work arbor support is of a box type with an adjustable arm that can be locked in any position. The single lever adjusts, locks and swivels the arm. The entire work arbor support unit can be removed when cutting large gears. The diameter and end fit of both the cutter and work spindles are independently adjusted and maintained without disturbing the setting of any other fit, or without dismantling or refitting the machine.

Pressure lubrication supplies oil automatically to the main mechanism in the gear case and to the work spindle, and includes cascade oiling to the change gears inclosed in oil-tight compartments. The worm and worm-

Fig. 2—Gould & Eberhardt No. 9-H Universal Gear Hobbing Machine

wheel drives to the cutter and work spindles are immersed in oil. The cutter slide guideways, stanchion, and immediate parts are lubricated by a gravity system. A separate pump and reservoir supplies coolant to the hob.

The machine is equipped with a single constant-speed driving pulley mounted on anti-friction bearings. Power is transmitted through a plate-type clutch arranged with a single adjustment. A safety frictional slip gear is interposed in the power traverse drive. Tubular belt guards that are adjustable in position are furnished. All operating controls are conveniently located.

The motor application is a direct-connected drive and can be made with either belt or silent chain. A constant-speed motor of 10 to 15 hp., 1,200 r.p.m., either a.c. or d.c., can be used.

The 9-H Machine

The 9-H small high-speed universal gear hobbing machine, as illustrated in Fig. 2, is particularly adapted for generating spur, helical, herringbone, and worm gears. The machine can cut gears up to 9 in. in diameter with the average support, and 12 in. in diameter with the support removed, and is rated for 10 D.P. in steel. The weight is approximately 2,800 pounds.

The vertical cutting principle is embodied in the machine, and the cutter slide is mounted on rectangular guides of the rigid box section stanchion, which is adjustable for depth and diameter of gears to be cut. The cutter slide can be swiveled through an angle of 180 deg. for cutting either right- or left-hand helical gears of any angle. The cutter arbor is portable to permit using arbors of different diameters, and particularly to accommodate small-diameter, solid-shank hobs. Pressure lubrication is used to supply oil automatically to the main mechanism in the gear case and includes cascade oiling to the change gears inclosed in oil-tight compartments. The indexing worm and wheel are immersed in oil. The cutter slide guide ways, stanchion, and immediate parts are lubricated by a gravity system. A separate pump and reservoir supplies coolant to the hob.

The machine is equipped with a single constant-speed driving pulley mounted on anti-friction bearings. The power is transmitted through a multiple plate-type clutch, arranged with a single convenient adjustment. Tubular belt guards that are adjustable in position are furnished. All operating controls are conveniently located.

The motor application is a direct-connected drive and can be made with either belt or silent chain. A constant speed motor of 3 hp., 1,200 r.p.m., either a.c. or d.c. can be used.

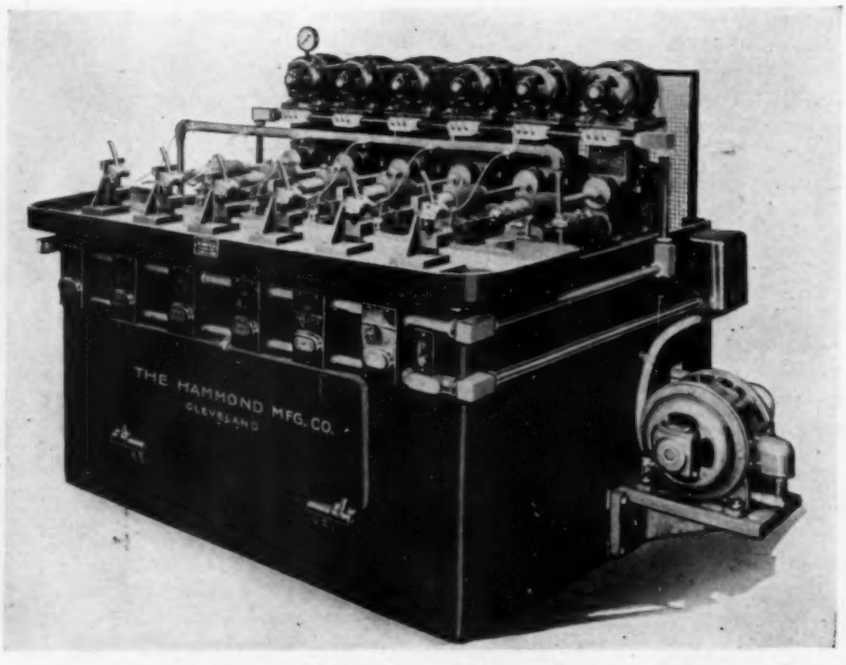
Hammond Six-Spindle, Deep-Hole, Oil-Feed Drilling Machine

THE machine shown in the illustration is designed for the purpose of drilling grease holes in shackle and king bolts, and is built by the Hammond Manufacturing Company, Cleveland, Ohio. It is fitted with a self-contained motor-drive that includes a 5-hp. motor for the main drive, and six ½-hp. motors for the drilling units. Spindle speed-changes are obtained through change pulleys providing suitable speeds for drills from ⅛ in. to ⅜ in. in diameter. The machine will drill to a depth of 6 in. Standard equipment includes drill chucks, motors and starting switches, lubricant pumps, oil-pressure pump and one set of fixtures. The machine is fitted with ball bearings throughout.

In operating the machine, the work to be drilled is chucked, and the particular unit to be used is engaged by a convenient finger trip. The drill is fed into the work under oil pressure, which can be varied to suit different requirements.

The quick advance of the drill to the work, as well as the withdrawal from the work, is controlled by a cam. The camshaft makes 10 r.p.m. and therefore the spindles advance to the work, drill, and withdraw from the work at the rate of 10 cycles per min. The mechanism is so designed that the penetration of the drill is greatest during the first drilling period. As the hole becomes deeper, the drilling period automatically shortens. An adjustable stop governs the final withdrawal of the drill for reloading the fixture. The drill is entirely withdrawn from the work at each cycle, enabling it to cool off and the hole to be flushed with coolant. Any spindle may be stopped independently of the others.

An extra-large chip chute is pro-

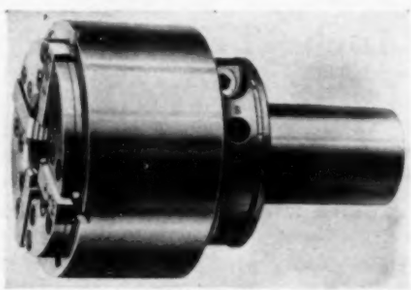


Hammond Six-Spindle, Deep-Hole, Oil-Feed Drilling Machine

vided, and is situated directly under the drills. The chips fall into a basket which can be readily removed from the front of the machine. The net weight of the machine is 5,000 lb. and the floor space occupied is 5 x 6 feet.

Geometric Style KJ, Solid, Adjustable Diehead

To meet the demand for a rigid, adjustable diehead the Geometric Tool Company, New Haven, Conn., has designed the tool shown which uses the same chasers as the company's KD and KH dieheads. This tool has a size adjustment mechanism that can be readily adjusted without removing the tool from its spindle or holder, yet which is so securely



Geometric Style KJ, Solid, Adjustable Diehead

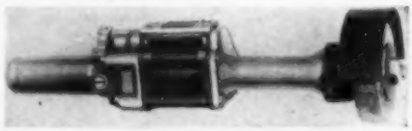
locked in place that the diehead will not change its size even when suddenly and repeatedly reversed at high speeds.

Chasers may be quickly and easily replaced by pressing down a thumb release on the back of the tool and pulling the chasers out with the fingers. These same chasers, while cutting, are not only supported along the sides and bottom with a supplementary support from the face plate on top, but are also backed up by a solid wall of metal directly behind the cutting point.

Rotor Type D-O Standard and High-Production Grinders

The type D-O grinder announced by The Rotor Air Tool Company, Cleveland, Ohio, is designed for 4x1-in. grinding wheels. The D-O model is similar in construction to the larger size D-1 model, and is especially handy for light grinding on a bench, or in close quarters. It is also recommended for the heavier types of die-grinding, using 3- and 4x1-in. wheels.

Two models are provided: One with a free speed of 6,000 r.p.m. for vitrified grinding wheels, the other the high production model running at 8,000 r.p.m. for rubber- or Bakelite-bonded wheels. Both models are equipped with the Rotor governor,



Rotor Type D-O Grinder

which controls the free speed and reduces the air consumption. It is claimed that the simplicity of construction, with only three moving parts, results in exceptionally low maintenance costs.

Gleason 3-Inch Spiral-Bevel Gear Generator

THIS small-size spiral bevel gear generator built by the Gleason Works, Rochester, N. Y., cuts gears of $3\frac{1}{8}$-in.-pitch diam., $\frac{1}{2}$-in. face, and $1\frac{1}{4}$-in. cone distance at a 4 to 1 ratio. The largest pitch angle which can be cut for gears mounted at right angles is 75 deg. 58 min., and the smallest, 14 deg. 2 min. The finest that can be cut is limited only by the point width of the cutter.

This machine employs the familiar generating principle of other Gleason bevel gear generators, in which the work and cutter are rolled relatively to each other during the cut in the manner of a gear meshing with a crown gear. The workhead is mounted on an oscillatory cradle, on which it is adjustable angularly, and in the direction of the axis of the work spindle, to permit setting the work to the proper cutting angle and cone distance. The generating roll is produced by the oscillation of the cradle and the action of a gear segment that is connected to the work spindle, and which rolls on a crown gear segment pivotally mounted on the frame of the machine. The cradle oscillation is obtained from a crank mounted on the same shaft with a cam that controls the alternate feed and withdrawal movements of the cutter slide for cutting and indexing. Means are provided for varying the amount of cradle roll. The indexing mechanism is of the notched-plate type and is actuated by the roll of the machine through suitable mechanism.

The work segments are adjustable so that each segment can cover a small range in pitch angles from

Fig. 1—Gleason 3-Inch Spiral Bevel Gear Generator

about 1 deg. on pinion segments to 7 deg. on the largest gear segments.

The cutters used are of the face-mill type with the blades integral with the head. These cutters are made in four standard diameters, ½, 1, 1.5, and 2 in., and all have four blades, except the ½-in. size, which has two. The cutters are made with alternate inside and outside cutting blades, so that both sides of a tooth slot are cut simultaneously. The cutter spindle is adjusted both vertically and horizontally for setting the cutter to any desired spiral angle and to permit cutting teeth of both right- and left-hand gears. An angular adjustment in a vertical plane is also provided. Through this adjustment it is possible to modify the tooth bearing of the gears produced, and it is also often possible to use one cutter for a range of work. All adjustments are made by means of graduated scales and dials with micrometer screws reading to thousandths. One of the marked improvements is the quick throw-out mechanism that enables the cutter slide to be moved instantaneously to or from the cutting position for loading. This mechanism is operated by a lever arm and only a single throw is necessary to move the cutter away from the work or return it to operating position.

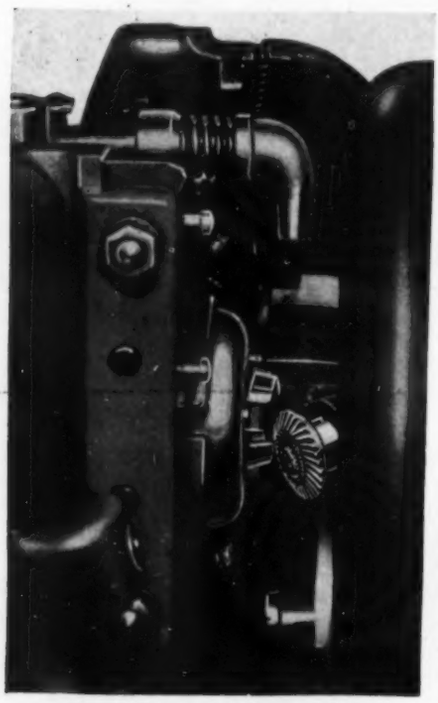


Fig. 2—View of the generating mechanism

The machine is driven by two ¼-hp. motors, both built-in and driving through flexible couplings to insure smooth quiet operation. One motor drives the cutter spindle and the other drives the main drive shaft. Each has a set of change gears for speed and feed variations. The cutter-drive motor has a reversing switch, so that the direction of cutter rotation can be changed to suit the hand of the cutter used.

A set of 33 feed and speed gears is furnished with the machine. The feeds obtainable are from 1 to 30 sec. per tooth. Cutter speeds vary from 75 to 250 ft. per min. Change gears not in use are stored on a swinging door in the base.

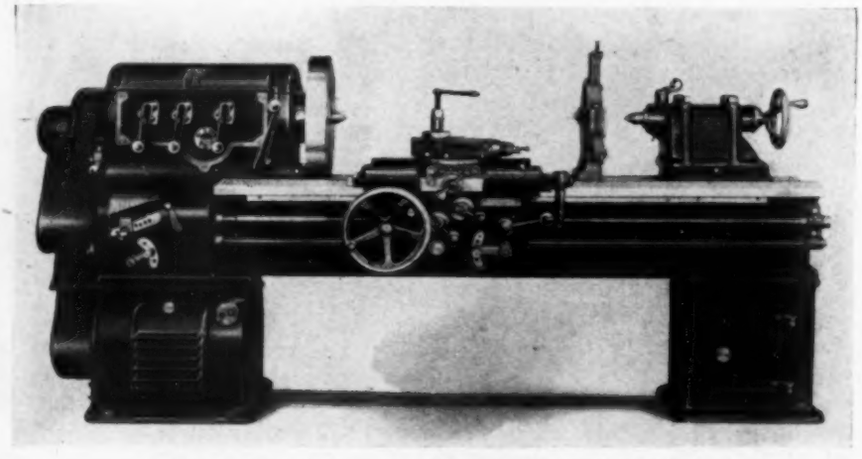
The cutter spindle is mounted on special ball bearings. A manually operated brake on the cutter motor driveshaft permits quick stopping of the cutter spindle and also holds it against rotation while changing cutters. The cutters are set up to the proper cutting position by a gage, which snaps automatically into a horizontal position so that all cutters are gaged alike. All high-speed shafts and the stud that carries the idler gear of the feed change gear set are mounted on ball bearings.

An oil reservoir built into the cutter head furnishes a constant supply of clean oil to the cutter spindle, while a circulating oil system built into the feed bracket circulates oil to all the points of the feed mechanism. Oiling points that do not require frequent attention have hand oilers.

Sidney 14- to 24-Inch "Tritrol" Engine Lathes

SIX "Tritrol" lathes in 14-, 16-, 18-, 20-, 22- and 24-in. sizes have been placed on the market by the Sidney Machine Tool Company, Sidney, Ohio. Each machine has eight spindle speeds. The Tritrol lathe is offered with two distinct types of headstocks, having three spindle control levers. The difference between the headstocks lies in the types of gears employed and the spindle bearings. Constantly-meshing, spur-tooth or herringbone, continuous-tooth gears, and Timken tapered roller bearings on all shafts or Timken bearings on intermediate and drive shafts and tapered bronze bearings on the spindle are the features of the two respective types. Positive jaw clutches permit changing of spindle speeds with the spindle in motion. The gears and clutches are heat-treated and accurately ground and all shafts and clutches are six splined. Forced-feed lubrication is supplied by a pump mounted on the drive shaft with oil sprayed to all moving parts of the headstock.

The apron is of double-walled box-type construction, insuring strength for heavy cuts and providing a method of control positive and instantaneous in action. Double stud bearings, heat-treated gears, and



"Tritrol" Engine Lathe with three-point bearing carriage

bronze bearings are other features of the apron. Instantaneous stopping and starting of longitudinal and cross feeds is made possible by a positive snap lever control which may be operated without effort. The entire surface of the clutch plate is toothed, assuring a continuous and smooth delivery of power for all cuts.

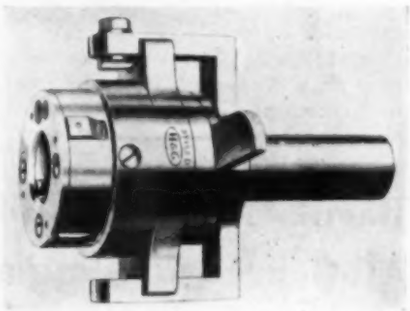
In order to obtain the necessary rigidity, the carriage is supported on three bearings and the cutting loads and forces are split over large areas on the front and back Vs with supporting bearing surface on the flat or inside of the large V directly under the point of the greatest load.

A special type of Texrope drive with V-belts can be furnished when desired. The motor drive arrangement includes the motor base in cabinet leg and drive by belt, chain, or levers.

The nominal base bed length for the first four sizes is 6 ft. and for the latter two, 8 and 10 ft., respectively. The swing over the carriage ranges from $10\frac{3}{4}$ to 16 in., and the swing over the compound rest bottom slide, $9\frac{3}{4}$ to $14\frac{7}{8}$ in. The distance between centers ranges from 2 ft. 4 in. for the smallest size to 4 ft. for the largest size, and the size of motor recommended ranges from 3 to 10 hp. The range of feeds per inch for the smallest machine is from 0.005 to 0.150 in. and for the largest machine 0.005 to 0.155 in. The number of thread and feed changes is 40 in the first four machines and 32 in the last two machines. The 14- and 16-in. machines take $\frac{5}{8}$x$1\frac{1}{4}$-in lathe tools, 18- and 20-in. machines, $\frac{3}{4}$x$1\frac{1}{2}$-in. lathe tools, and the 22- and 24-in. machines, $\frac{7}{8}$x$1\frac{3}{4}$-in. lathe tools. The headstock spindle speeds range from 13 to 414 r.p.m. for the first machine and from 8 to 350 r.p.m. for the last machine. Each machine is furnished with a large and a small faceplate, steadyrest, chasing dial, two centers, and a complete set of wrenches.

"H & G" Style D Self-Opening Diehead

The style D diehead introduced by Eastern Machine Screw Corporation, New Haven, Conn., is designed principally for use on B. & S. automatic machines and small Clevelands. The head is provided with ample float and has the double-drive feature, which prevents cramping, insures smooth action, and at the same time gives the head strength. The head trips by a pull-out action as the cam dwells. The length-of-thread adjustment is self contained on the upper driving arm, thus providing control of thread lengths without changing the setting of the machine or moving the head. The head is closed automatically. Rotation of the turret causes the closing handle to engage with a dog on the machine, which is set to an angle to close properly. The reverse belt on the small machine, instead of being used back of the die, may provide an additional forward cutting speed and does away with left-hand tools.



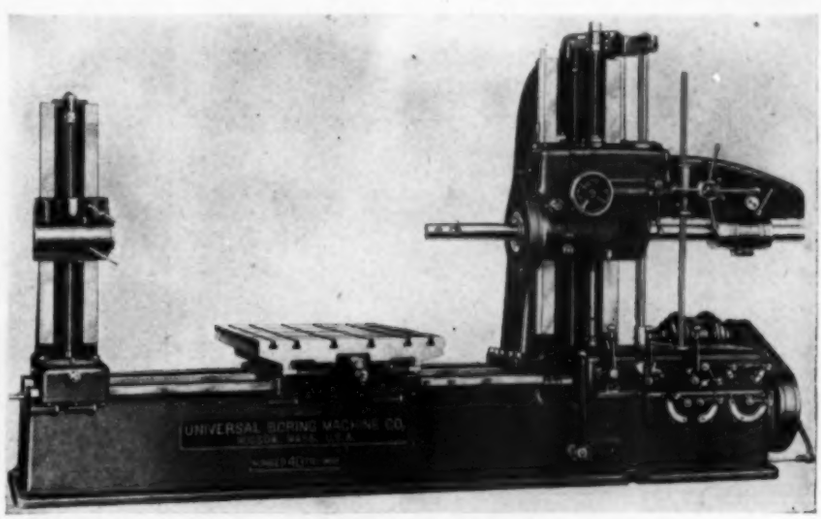
"H & G" Style D Self-Opening Diehead for use on B. & S. Automatics and small Clevelands

The style D diehead is manufactured in seven sizes as follows: $\frac{1}{4}$, $\frac{7}{16}$, $\frac{9}{16}$, and 1 in. and No. 4 and No. 6. The diameter of the body varies from $1\frac{9}{32}$ to $3\frac{1}{4}$ in., and the overall length $3\frac{5}{16}$ to 7inches.

Universal No. 40 Tri-Way Horizontal Boring Machine

THIS machine, built by the Universal Boring Machine Company, Hudson, Mass., has a 4-in. spindle in a 6-in. diam. quill and running in Timken bearings. The spindle has a 30-in. travel without resetting, and has a total travel of 60 in. All spindle driving shafts and gears are of heat-treated, chrome-nickel steel, mounted on ball and roller bearings, as is also the case for the six-splined vertical drive shaft, which transmits power from the gearbox to the boring head. The driving gear in the head is mounted on ball bearings independent of the shaft. A pump supplies lubrication to all revolving bearings in both the head and the gearbox.

Spindle speeds vary from 8 to 300 r.p.m. Gears are of coarse pitch and wide face and have stub teeth. All spindle driving gears, whether fixed or sliding, are mounted on 6-splined shafts. Two feed ranges are provided, one for milling and the other for boring. The feeds for milling are from 0.53 to 11 in. per min., and for boring, from 0.13 in. to 2.75 in., one-



Universal No. 40 Tri-Way Horizontal Boring Machine

quarter as fast as the milling feed. equipment.

The machine shown has a table 40x64 in. with a cross feed of 48 in. The maximum distance between the faceplate and the outer support is 96 in., and the maximum height from the table to the spindle is 32½ in. A motor with chain drive is standard equipment.

Barnes No. 262 Sliding-Head, Self-Oiling, All-Geared Drilling and Tapping Machine

THIS machine is built by the Barnes Drill Company, Rockford, Ill., with box-section construction for column and for head. There are eight quick-change, geared speeds, with lever controls extended to the front for the convenience of operator. Eight spur-geared feeds, with lever quick-change controls are in the front of the machine, the speeds being clearly indicated for each setting of the levers.

The base is surrounded by oil channels and has a sump for coolant at the rear. Silent, inclosed, chain drive or single-pulley drive is furnished as standard equipment.

The spindle is of 6-spline construction, 2 in. in diameter, and has a roller thrust bearing. Regular spindle travel at any setting of the head is 15½ in. Regular travel of the sliding head is 19½ in. Levers are provided for quickly raising and lowering the sliding head and clamping it in any desired position on the column. The spindle sleeve has a split bearing to take up wear. The cap is of Gunite metal and is provided with laminated shims.

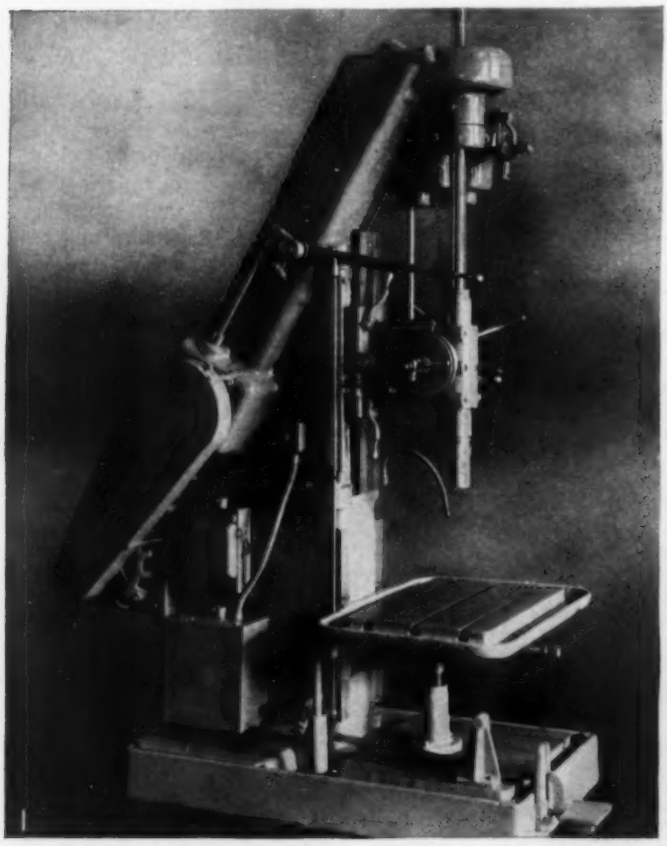
Every bearing is oiled automatically. The machine takes high-speed twist drills up to 2½ in. and bores an 8 in. hole in cast iron. Spiral crown gears of heat-treated steel are used in any one of three ratios, 1 to 1, 2 to 1, and 3 to 2. The machine has anti-friction bearings throughout.

The height of the machine is 94 in.; face of column to center of table, 13 1/16 in.; spindle, 2 in. in diameter, with No. 4 Morse taper; vertical travel of table, 17½ in., and of spindle, 15½ in.; maximum distance from spindle to base, 50 in.; net weight, 3,500 pounds.

Power Rapid Traverse for American "Auto-Oiled" Shapers

The American Tool Works Company, Cincinnati, Ohio, offers a power table traverse for American "Auto-Oiled" shapers. This traverse is a self-contained, motor-driven unit, entirely independent of the operating mechanism of the shaper. It never runs idle, since it is in action only when the table is moved along the rail under power.

The drive for the power traverse



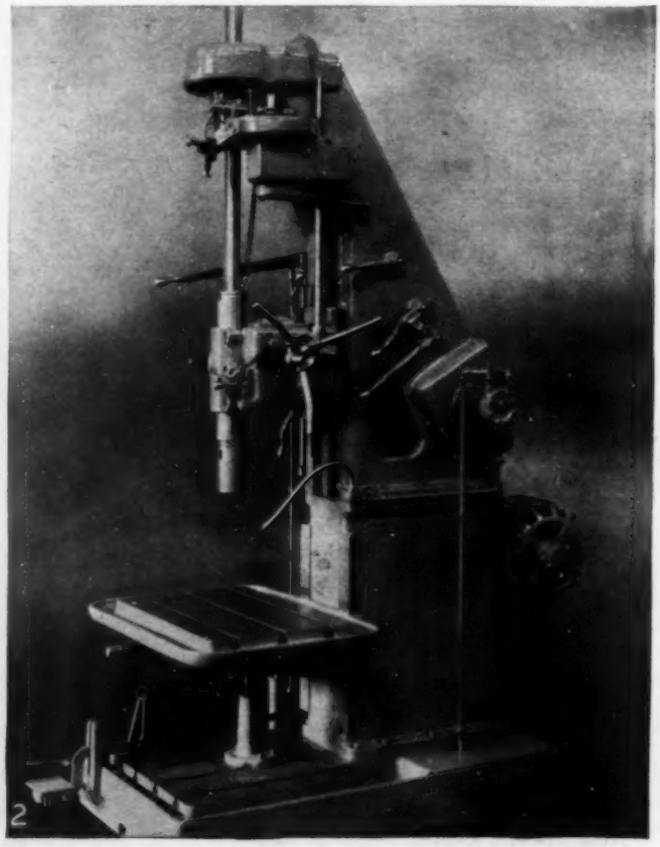
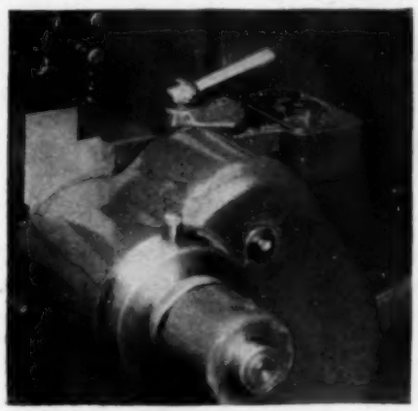


Fig. 1—Barnes No. 262 Sliding-Head, Self-Oiling, All-Geared Drilling and Tapping Machine. Fig. 2—Left view of the Barnes No. 262 Machine

is a small motor mounted on the "off" side of the column and connected to the crossfeed screw by means of a worm and worm gear. A forward and reverse pushbutton control located at the operating end of the rail starts and stops the traverse. The traverse may be operated while the machine itself is at rest.

As a safety feature, a power-feed engaging lever controls an automatic lockout for the power traverse, pre-



Power Rapid Traverse for American "Auto-Oiled" Shapers

venting the latter from becoming engaged while the power feed is functioning. Before the power traverse of the table will act, this lever must be set centrally, thus disengaging the power feed.

Geometric Classes SJ and R Adjustable Taps

The Geometric Tool Company, New Haven, Conn., has brought out two taps, shown in Figs. 1 and 2. One of the features of the tap in Fig. 1 is that all working parts, even the size adjustment mechanism, are

Fig. 1—Geometric Class SJ, Solid, Adjustable Tap

located in the nose or front end of the tool, making the portion of the tool carrying the chasers the largest diameter of the tap and allowing it to cut threads to any required depth. This tap will swing in small space. It is short, not much longer than the chasers, avoiding overhang and allowing it to swing on machines having a limited clearance. Because of its compactness and its positive and accurate size adjustment, this tool can be used on chucking machines and similar equipment and for sizing either by machine or by hand.

In Fig. 2 is the Class R receding chaser tap, designed for tapping taper threads where the depth is great and the taper is steep in tough material. The tap is a complete unit in itself. On even the larger sizes no outside tripping mechanism is required, and all working parts are fully inclosed.

In operation, the tap advances to the work as a jam-cut tool. After the chasers are in the cut an adjustable taper bar, working through a pawl onto the chaser plunger, causes the chasers to recede as they advance into

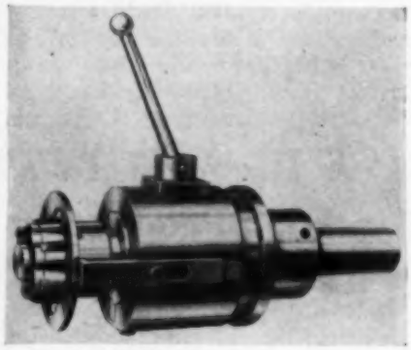


Fig. 2—Geometric Class R, Receding, Chaser Tap

the work. At a predetermined point the chasers collapse and the tool may be backed out from the work at any desired speed. The tool can be used as a stationary type tap with plate trip, a rotary tap with plate trip, or a rotary tap with a sleeve trip.

Canedy-Otto Multiple-Spindle Drills

THE multiple-spindle, sensitive drilling machines offered by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill., have been designed to give speed and accuracy where large production is required. The machines may be had with two, three, four or six spindles. Each spindle has an individual motor drive, allowing it to be run at any desired speed, or stopped, without interfering with the other spindles. All spindles have ball-thrust bearings and are supported by sleeves with long bearings. Cone-pulleys rotate on Timken bearings. Belt tighteners similar to those on the other drilling machines, described on pages 518 and 524, are provided. Motors are also similar. A large oil-grooved table is provided which can be lowered or raised to any required height on the column, and clamped securely by the locking handle, which is conveniently located. Drills come equipped with necessary lighting cords and toggle switches. They may be obtained in either the bench or the pedestal type.

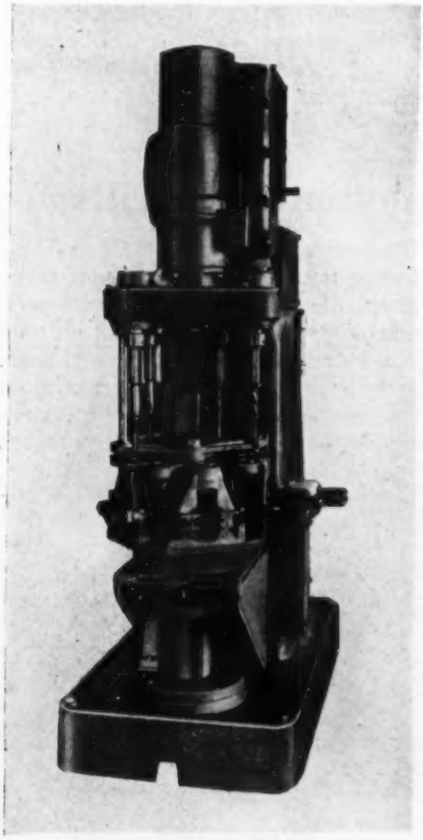
Speeds varying from 400 to 10,000 r.p.m. may be obtained for these machines, in groups of three speeds. The group variations are as follows: 400 to 1,750 r.p.m., 525 to 3,000 r.p.m., 1,000 to 5,000 r.p.m. and 3,400 to 10,000 r.p.m. Each has an intermediate speed. All tables are 16 in. wide, but vary from 20 to 72 in. in length, depending upon the number of spindles. For the two slower-speed machines the spindles will handle No. 1 and No. 2 Morse taper shanks, and the machines have a maximum drilling capacity in steel of $\frac{1}{2}$ in. Both high-speed machines use Jacobs

Canedy-Otto Three-Spindle Multiple Drill, one of the series

chucks. The 1,000 to 5,000-r.p.m. machine uses a No. 32 chuck and the 3,400 to 10,000-r.p.m. machine uses a No. 30 chuck. These machines have a maximum drilling capacity, in steel, of $\frac{3}{8}$ in. and $\frac{5}{16}$ in., respectively. The net weight of the machines varies from 575 to 2,050 pounds.

Hoefer 5- to 7½-Horsepower High-Production Drilling Machine

THIS machine is made by the Hoefer Manufacturing Company, Freeport, Ill., with either an indexing or a constantly-rotating worktable, as desired. The multiple-spindle head is bolted to the main head and carries tools for various operations. Any of



Hoefer 5- to 7½-Horsepower, High-Production Drilling Machine

the spindles can be made to reverse for tapping or threading. Fixed depths of cuts are secured by vertical adjustment of spindles. Ball and roller bearings are used, the heads operating in an oil bath. Change gears give speed the variations desired.

Holding fixtures, designed to suit the work, are mounted on the table, which can have screw, cam or hydraulic feed. A Geneva movement is used on the indexing machine with cam or screw feed. On machines with hydraulic feed the indexing mechanism is of hydraulic type. On the continuously-rotating machine the table has no vertical movement. Two horizontal cams on the machine column give the vertical feed in both directions. A four-sided central column with anti-friction bearings carries four slides on which are mounted four single-spindle head units. The upper ends of these units contact with cams in the dome, which give the feed required. Four holding fixtures, either single or in multiples, are mounted on the table, each fixture maintaining a fixed relation to each single spindle head. The main table, fixtures, central column and single spindle heads rotate in unison. One-fourth of the rotation is used for loading and unloading the parts from the fixture.

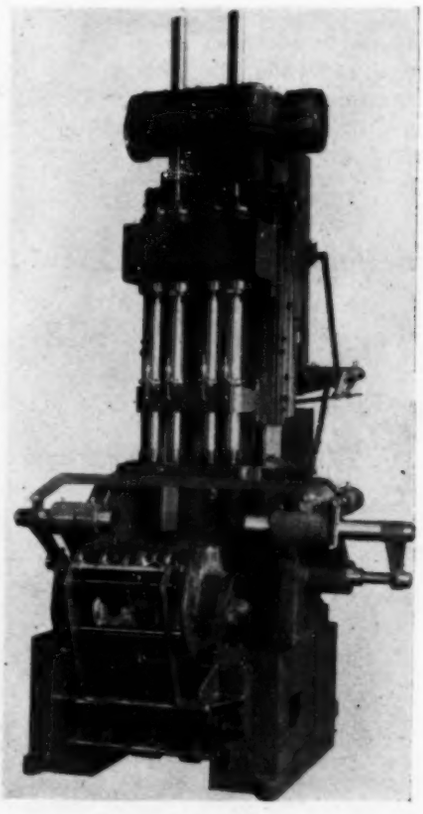
Moline No. 14 "Hole Hog" Cylinder Borer

ANNOUNCEMENT is made by the Moline Tool Company, Moline, Ill., of the No. 14 "Hole Hog" cylinder borer. This machine is intended for high production on a definite set-up, and deviates from the standard practice of the company of having independent spindle units adjustable for center distances between spindles. The new design includes the use of Timken bearings for all the spindles, which are adjustable for wear. Every running bearing throughout the machine is either roller or ball bearing. The illustration shows the machine complete with jigs and tools for reaming on a V-type eight-cylinder block.

In general, the machine is similar to other "Hole Hog" boring machines, in that the double V-guide construction is used, as well as the Oilgear feed mechanism, with the cylinder located between the Vs and the pump enclosed within the column.

The motor is mounted on top of the column and transmits power to the main drive shaft through a Morse silent chain. The upper driving mechanism is fixed with respect to the column, the power being transmitted from the main horizontal drive shaft to the two vertical intermediate shafts through hardened steel and bronze spiral gears running in oil. These two vertical shafts are multi-splined, and on their ends are mounted hardened steel pinions meshing with the gears on spindles. These gears are also immersed in oil.

Six of these machines constitute a battery: two roughers, one for one series of holes, and the other for the other line of holes, two machines for the semi-finishing, and two for the reaming operations. The fixture can be swung out in line with the conveyor so that the cylinder can be pushed into the cradle jig, and, by very little effort in raising the lever at the front and center of fixture,



Moline No. 14 "Hole Hog" Cylinder Borer

the entire cradle can be returned to the working position. By turning the crank at the right of fixture, the two locating plungers enter the main crank shaft bearings, and simultaneously the two guide and clamp plungers are brought into position, centering and clamping the block in place.

In all cases, the boring bars are made just as long as possible. In the roughing operation they are guided at the top of the fixture, just as close to the work as possible, and in the semi-finishing operation are piloted both above and below the work. In the case of the reaming operation, as illustrated, the guide is mounted on the bottom of the slide and is not piloted directly in the fixture.

The specifications are as follows: Travel of head, 24 in.; width of Vs, 27 in.; length of slide, 48 in.; power required, 25 hp.; spindle construction made to suit; weight of machine complete with fixture and tools, 17,350 pounds.

Automatic Feeding Device for Model U "Lo-Swing" Automatic Lathe

A COMPLETELY automatic work-feeding device, for application on the Model U "Lo-Swing" full automatic lathe recently developed and placed on the market by the Seneca Falls Machine Company, Seneca Falls, N. Y., handles cylindrical work of comparatively short length, such as automobile pistons. The machine itself was developed primarily for the turning and grooving of automobile pistons, but it can be adapted to the turning of any similar work. It was described on page 912, Vol. 70, of the *American Machinist*.

No Attendant Required

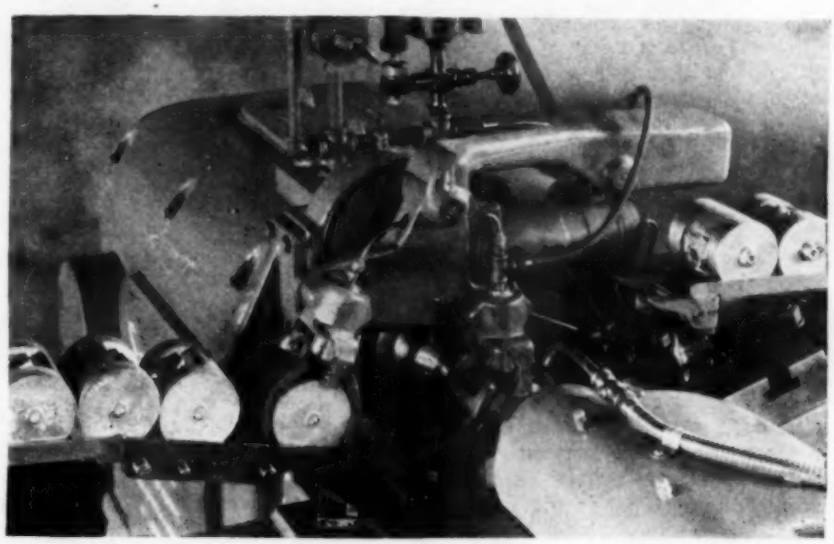
The machine, with the work-feeding device, is entirely automatic in that no operator is required either for placing the work in the operating position or for removing it from the machine. A push-button starts the machine, which will continue to perform its work without any attention until it is stopped. All that is necessary is to place the pistons to be operated upon in a chute or runway, which is done by the operator who performs the next previous operation on the pistons.

Briefly, the cycle of operation is as follows: The piston to be machined is automatically picked up from the runway by the work-feeding device and placed in the operating position in the machine, where it is held between a pneumatically-operated tail-center and a dowel-center that fits into the open end of the piston. The latter is then driven by the bosses on the inside in the conventional way. There is one tool-holding slide on each side of the machine. The front slide or carriage, which moves in a direction parallel with the axis of the piston, holds the piston-turning tools, while the rear slide carries the tools for grooving, facing, and forming.

When these operations have been performed, the piston is automatically removed by the work-feeding device from the machining position and deposited on a runway on the opposite side of the machine from that where the pistons are fed into the machine. This runway carries it to the next operation, and the piston is removed from it by the operator performing that operation in another machine. Simultaneously with the removal of one piston from the machining position, another piston is automatically taken from the incoming runway and placed in the working position.

The operating mechanism that actuates the automatic movements may be described as follows: A motor in the base of the machine drives the main shaft either by means of a belt or chain. From this main shaft the different operating and feed motions are obtained through gearing and cams, all the tool-slides being cam-operated. Pick-off gears are provided for changing the speeds and feeds as desired.

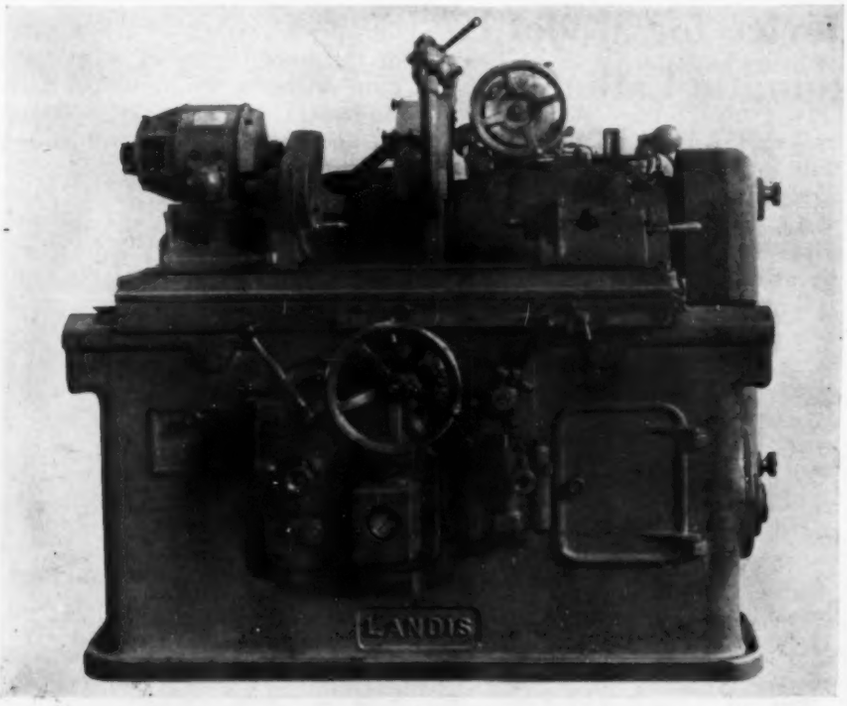
The work-feeding device, or loading and unloading mechanism, and the tailstock center are pneumatically operated and controlled by adjustable cams operating the pneumatic valves. As may be seen from the illustration, the machine is provided with two sets of gripping fingers designed to have much the same action as the human hand. These "hands" are also pneumatically controlled. The piston is picked up, moved over to the operating position and held there until it is located and gripped between the tail and headcenters, when the "hand" is withdrawn. The same cycle is repeated for removing the piston, the two "hands" operating simultaneously, one removing a piston just as the other brings a new piston between the centers. The approximate time for removing and loading automobile pistons is 3½ sec. from the moment that the tools have finished their work until they start to cut on the next piston.



Automatic Feeding Device for "Lo-Swing" Model U Automatic Lathe

Landis Type C, 6-Inch Plain Hydraulic Grinder

A HIGH-PRODUCTION grinder for the rapid production of axle shafts, stub shafts, small motor armatures, and armature shafts, bearings, twist drills, and other similar small parts has been placed on the market by the Landis Tool Company, Waynesboro, Pa. A distinctive feature of this grinder is the hydraulic work carriage traverse with quickly available traversing speeds ranging from 12 to 360 in. per min. A 24-in. diameter grinding wheel is used, and is driven through multiple V-belts to the spindle.



Landis Type C, 6-Inch Plain Hydraulic Grinder

Both electric motors are attached to the machine, and the water tank is integral with the bed, making a self-contained unit. The weight in the bed is properly distributed to carry the wheel base with its large diameter wheel. The base of the bed forms a reservoir for the oil used by the hydraulic traversing system. The work carriage traverses on a V and a flat slide with chilled surfaces wholly protected, and spaced to give solid support. Tarry, which is adjustable, is regulated by a needle valve, and the usual method of swiveling is utilized.

Bearings for the spindle are steel backed, babbitted bearings, and are adjustable for wear. Continuous spindle bearing lubrication is provided by means of a pump driven by the spindle itself. The oil is filtered before it enters the bearing, and the oil gage is always visible from the front of the machine. The spindle is of alloy steel, driven from the end by multiple V-belts, and an extra spindle pulley is furnished for use after the wheel wears down.

The traversing oil pump is of the low-pressure geared type. All parts run in oil, and anti-friction bearings are used. The traversing oil motor, is of the four-impulse, two-chamber, continuous type. As with the pump, all parts run in oil and anti-friction bearings are used. A throttle valve controls the speed of the motor. A balanced piston-type, reversing valve governs the reversal.

The grinding wheel cross feed is either automatic or hand operated, in either case through a long feed screw and a bronze half nut. Hydraulic pressure working through a small rotary motor actuates the automatic feed.

The headstock is driven by an individual motor of the variable-speed type, and speed reduction is secured through a compact, double-chain arrangement with automatic adjustment. Plain bearings, adjustable for wear, are used in the faceplate. Provision has been made for mounting and driving a d.c. generator at the rear of the machine, when d.c. current is not available.

The main drive motor is mounted on the rear of the bed with the pulley directly aligned with the wheel spindle pulley. The multiple V-belt drive is equipped with a gravity idler.

Hydraulic straight infeed to the grinding wheel head and a reciprocating wheel spindle mechanism may be supplied for plunge-cut grinding.

"O K" Offset Side-Lock Toolholders

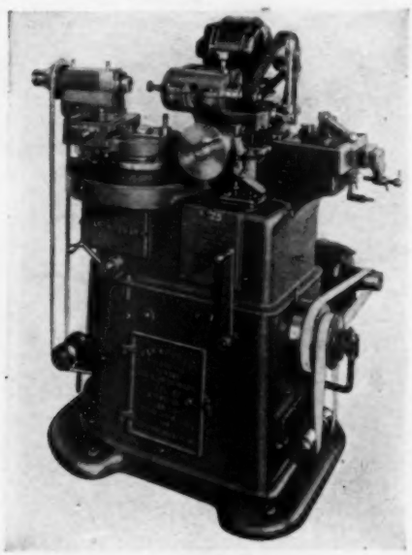
Offset side-lock holders similar to the regular Series 043 and 044 side-lock holders, except that the holder overhangs from the side of the toolpost instead of from the front, have been placed on the market by the O. K. Tool Company, Shelton, Conn.

"O K" Offset Side-Lock Toolholder

This construction permits rigidity and allows the tool to be used for multiple-tooling operations. For example, one holder projects from one side of the turret toolpost, while another holder is adjustable along the next side of the turret toolpost, allowing different diameters to be turned or two surfaces to be faced. The holder is made right- or left-hand and is of drop-forged, chrome-nickel steel, heat-treated. It is made for bit shanks from $\frac{3}{8}$ to 1 in.

Van Norman No. 25 Oscillating Grinder

THE No. 25 oscillating grinder, built by the Van Norman Machine Tool Company, Springfield, Mass., incorporates several improved features, the main improvement being that it has a two-motor control. One motor drives direct by belt to the wheel head. The other drives over to the idler pulleys that control the workhead rotation and oscillation as well as the automatic feeds. The regular wheel-slide construction is used, but there is a different type of feed mechanism whereby the feed



Van Norman No. 25 Oscillating Grinder

can be set so as to rough grind the race to within 0.002 in. of the finish ground size of the cup, when it is automatically changed from coarse to fine feed. The wheel-slide construction now has a quick throw-out lever for removing the wheel instantaneously from the work, eliminating the necessity of turning the cross-feed handwheel. With this machine it is necessary to turn the feed handwheel only once and clear the wheel by means of the throw-out lever, which is conveniently located.

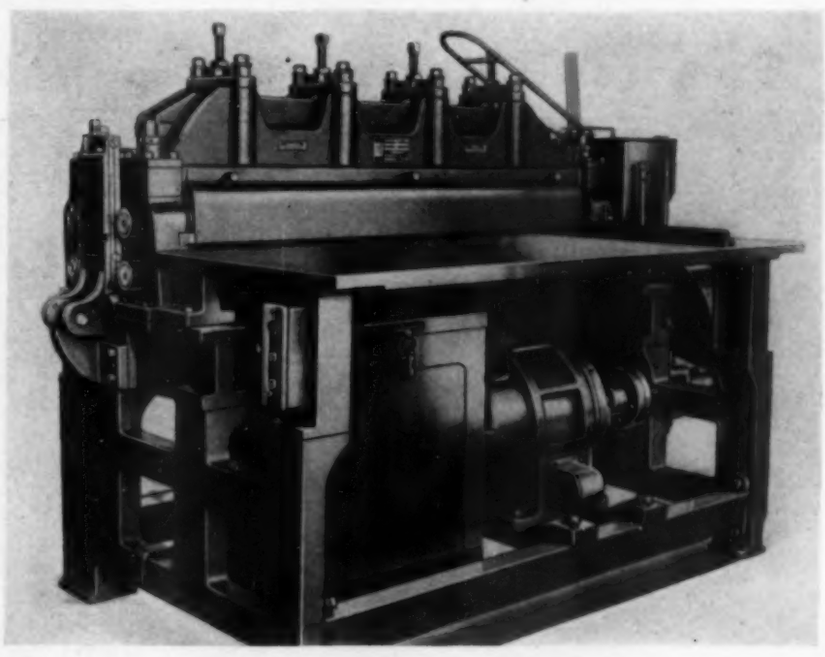
Two levers are shown on the front of the machine. The one on the left-hand side controls the position of the main single drive-belt and moves it from the tight to the loose pulley located on the back countershaft, thus stopping the whole machine. The one on the right controls both the workhead rotation and the oscillation. This one lever eliminates five movements that were formerly necessary to insure the same results. The workhead is driven by a ½-in. round belt that is carried up through an opening in the base, from a ball-bearing pulley located directly below the center of oscillation. This drive gives a positive rotation to the workhead at both ends and center of the stroke, eliminating the possibility of ridges in the bearing surface. The weight of the machine is approximately 1,900 lb. The motors used are: for workhead and automatic feeds, 1-hp. 1,150 r.p.m. for wheelhead, 1½ hp. 3,450 rev. per minute.

Putnam Type K, Rotary, Gang-Slitting Machine

THE Putnam Machine Works, Division of Manning, Maxwell & Moore, Inc., Fitchburg, Mass., is introducing slitting machines that are improvements of the Lamb & Nash slitters, which are built in three sizes in the "K" type. These machines are arranged with the cutter frames interposed between two sets of feed-rolls. The cutter frame carries the two cutter-shafts and is arranged to swing out from between the rolls to give accessibility in setting up and adjusting the cutters. There are two types of cutter frames, the solid cutter frame which is standard equipment, and the adjustable cutter frame which is furnished as extra.

The solid-cutter frame is designed only for the chair-type cutters, these cutters being fitted to, and supported in, chair-shaped bearings. With this type of cutter, the cutter-shaft does not support the cutters, but functions only as a driver. The chair bearings that carry the cutters are rigidly clamped to the cutter frame.

The chair-type cutter bearings are bronze-bushed and fitted with flush-type grease cups for use with a pressure gun. The necessity of length in the bearings, plus the width of the cutters, determines the minimum width of cuts that may be taken with the chair-type cutters. When cuts are required that are narrower than the minimum-width chair-type cutters, it is necessary to use an adjustable cutter frame with the block-type cutters. The intake and discharge rolls are provided with adjustments by which the rolls may be set apart



Putnam Type K, Rotary, Gang-Slitting Machine

slightly less than the approximate thickness of the stock to be cut. The rolls exert sufficient pressure to feed the stock. The discharge rolls are hardened and ground to resist the cutting of the rolls by the edges of the cut strips. Both sets of rolls are power-driven and are geared direct to the cutter-shaft gearing to insure positive rotation to rolls and cutter shafts. Belt or motor drive is furnished.

Walker Model D Single-Stroke Surface Grinding Machine

WHILE generally similar in appearance to previous models, the Model D single-stroke grinding machine just introduced by the O. S. Walker Company, Incorporated, Worcester, Mass., differs in several particulars. In this model the fitting of the driving motor to the machine has been simplified by a change to the type of base illustrated in Fig. 1, which shows the machine with the wheel head in the highest position.

Another change is the provision of means for tilting the table which carries the chuck bracket. This change will be evident from a study of Fig. 2 in which the table is shown in the normal position for grinding flat work, with the wheelhead carrying member moved forward to its normal position on the base. This ability to adjust the wheelhead carrying member is another innovation and makes it possible for the machine to grind the hubs of cutters and saws up to 6 in. in diameter.

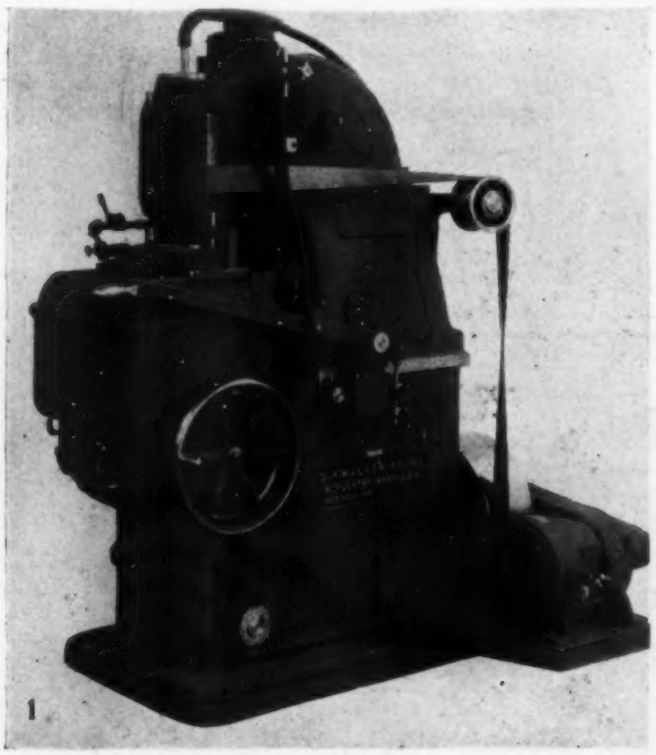
A 7½-hp. motor is required, and the weight of the complete machine has been increased to about 5,000 lb. by the refinements mentioned. The other specifications are the same as those for the previous model.

Bending Attachment for Buffalo Bending Machine

The Buffalo Forge Company, Buffalo, N. Y., has introduced an attachment for application to its line of bending machines, or rolls. This attachment can be used for both "leg in" and "leg out" bends and no preliminary bending is necessary. It also serves as a gage and is useful in opening up rings bent to too small diameters.

The attachment will handle angles, channels, beams, and flats on edge, bars, squares, pipes and tubing, and sheets.

Bending Attachment for Buffalo Bending Machine



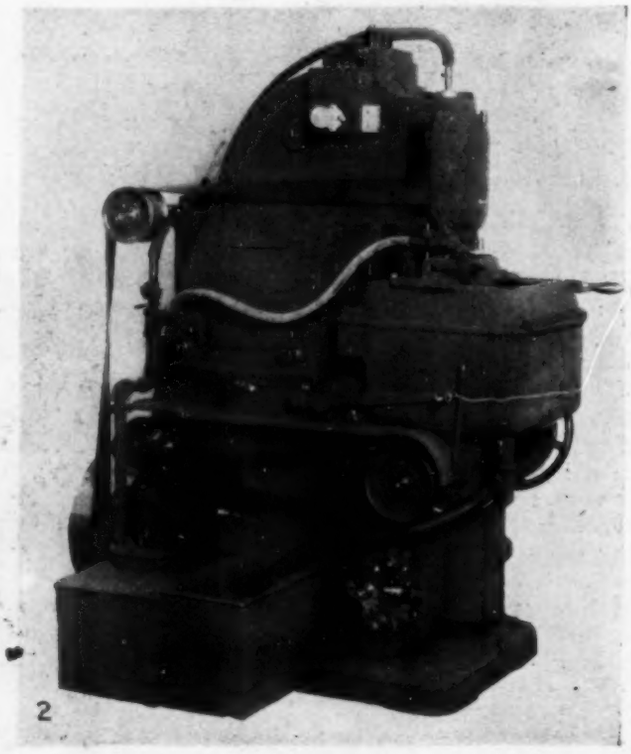


Fig. 1—Walker Model D Single-Stroke Surface Grinding Machine with wheelhead in the highest position. Fig. 2—Walker Grinder with wheelhead and work table in normal position for grinding flat work

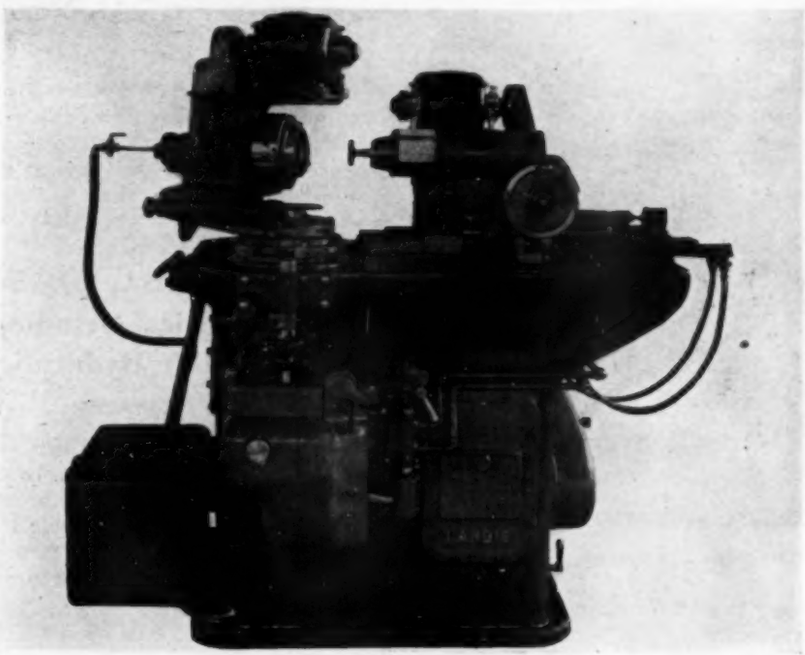
Landis 5-Inch, Semi-Automatic, Hydraulic, Ball-Race Grinder

THE Landis Tool Company, Waynesboro, Pa., has applied hydraulic mechanism to oscillating the workhead, feeding the wheelhead, and traversing the wheel slide of this 5-in. machine for radial grinding of any kind within its range.

The operator merely loads the work and throws the main control lever. Work rotation, workhead oscillation, and wheel-carriage traversal start simultaneously. At about the end of the wheel-carriage movement, the wheelhead starts to feed in rapidly, slowing down as the wheel nears the work, and as the wheel comes in contact with the work, the grinding feed is engaged. From that point on the grinding feed controls the speed of the feeding-in movement, which ceases when the feed comes against a positive stop, indicating that the work has been ground to size. Throwing the main control lever in the opposite direction reverses all the movements, causing the wheel and workheads to return to their starting positions, at which point work rotation and workhead oscillation stop automatically with the head in its back position. This stopping facilitates changing the work, so that the operator can run two machines easily.

Three constant-speed, balanced motors are attached to the machine. This arrangement, and the fact that the water tank is attached to the bed, makes the machine entirely self-contained.

The grinding-wheel spindle runs at about 7,760 r.p.m. in steel-backed, babbitted bearings, adjustable for wear. It is driven through a flat-woven endless belt by a motor mounted on the rear of the wheelhead. Lubrication is by sight-feed oilers. The grinding-wheel feed is operated by a hydraulic piston and cylinder that feeds the wheel both during the rapid feed and the grinding feed movement, although during the latter a hydraulic feed regulating device is brought into play. The grinding-feed movement is regulated easily and stops automatically when the work has been ground to size. To compensate for wear, the wheel may be fed in by hand. The wheelhead slide is traversed by hydraulic power. Its piston is so connected with the wheelhead piston that the movements cannot get out of time. A hydraulic cushioning device prevents any shock.

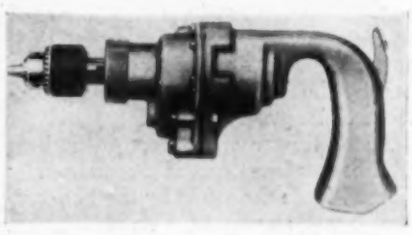


Landis 5-Inch, Semi-Automatic, Hydraulic, Ball-Race Grinder

The grinding-wheel truing fixture is attached to the front of the wheelhead only when in use. It is adjustable for different radii, and is fed to the grinding wheel by a screw having a graduated dial. The vertical oscillating spindle is fitted with heavy, pre-loaded ball bearings and is oscillated by a double-blade-type oil motor. A balanced-piston-type reversing valve is used. Adjustable reversing dogs, mounted on a ring at the top of the spindle, regulate the length of the arc of oscillation. The workhead spindle runs in adjustable steel backed, babbitted bearings, and is driven by a motor mounted over the oscillating center. Because of a combination of two slides at the base of the workhead, the head may be adjusted toward the center of oscillation, or at right angles to this movement. The oil pump is of the low-pressure, geared type. It is driven by multiple V-belts direct from a pulley mounted on the armature shaft of the main drive motor. The pump-shaft extends into the bed where it is coupled to the water-pump shaft, which it drives.

Rotor Type E-O High Production Drill

The Rotor Air Tool Company, Cleveland, Ohio, announces the "High-Production" E-O drill, in capacities of $\frac{1}{4}$, $\frac{A}{16}$ and $\frac{3}{8}$ in., for high-speed production work. This drill is exceptionally light, weighing less than 4 lb. in all models, and, according to the claims of the maker, can be used continuously on production work without fatigue to the operator. The motor produces over 0.5 hp. and the compound gears give high torque. Three speeds are provided, 1,000, 1,500, and 2,000 r.p.m. All models are furnished with a grip throttle and a Jacobs chuck.



Rotor Type E-O High-Production Drill

Gardner No. 84 Special Hexagon Nut Grinder

THIS equipment, recently introduced by the Gardner Machine Company, Beloit, Wis., consists of a No. 84 Gardner grinder on the front of which is mounted a rotary attachment with special work-carrier and timing device. On the end of the rotor shaft is mounted a cast-steel disk with a series of studs suitable for the work to be handled. Two side guides are provided to keep the nuts from turning and present them to the grinding wheels in the proper position. On the upper guide is mounted an indexing device which turns each nut one-sixth of a revolution as it passes, thus presenting two new surfaces to be ground.

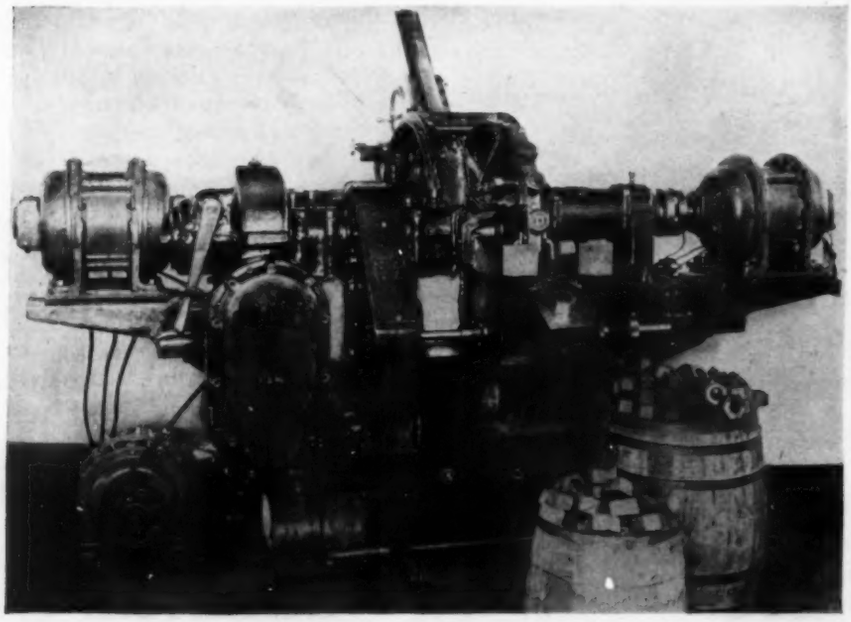


Fig. 1—Gardner No. 84 Special Hexagon Nut Grinder

After the nut has been ground on all six surfaces, it is automatically ejected from the studs by the two vertical arms shown in Fig. 2. These arms, one on each side of the nut, are actuated by a cam arrangement so that the nut passes between the wheels three times before being ejected.

In the operation of this device, the attendant is required only to keep the empty stud reloaded as it comes around. In starting to load the carrier when it is entirely empty, it is necessary for the operator to watch these unloading arms and load only the stud from which the nut would have been ejected had there been any on it. After doing this for three revolutions of the carrier it will be entirely filled, and then it is only necessary to load the empty studs as they come around.

The unit is equipped with both a hand- and a foot-lever, connected with the friction clutch for stopping and starting the feeding mechanism. This provision enables the operator to stop the carrier instantly, should it be necessary, simply by stepping on the foot-lever.

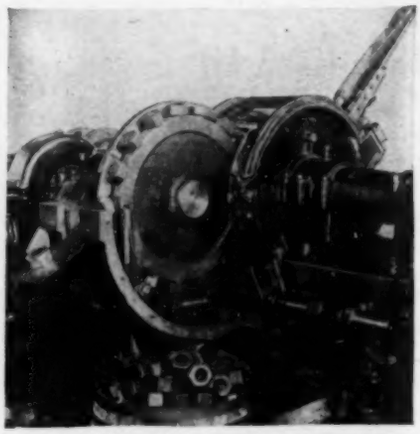
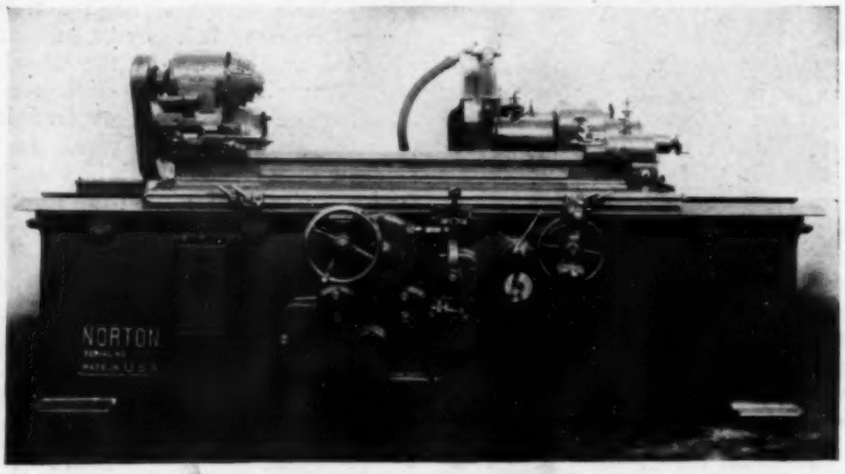


Fig. 2—Rear view showing the ejecting mechanism

Norton Type BA, 10x50-Inch, Cylindrical Grinding Machine with Hydraulic Table Traverse

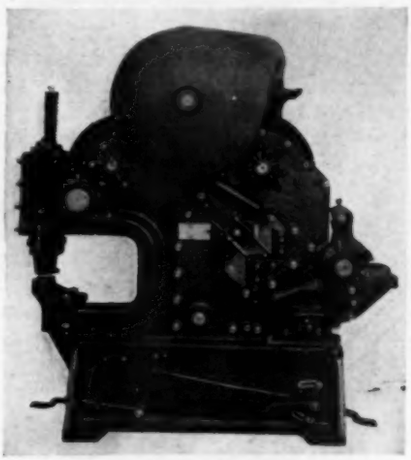
The type BA cylinder grinding machine of the Norton Company, Worcester, Mass., has been improved by the use of a hydraulic table traverse, which provides a greater range and an infinite number of changes of table speed. It is also smooth in operation and quiet at reversal. The former design of the wheel spindle, with flood lubrication and bearings adjusted while running, is retained.



Norton Type BA, 10x50-Inch, Cylindrical Grinding Machine with Hydraulic Table Traverse

Ryerson No. 7 Combination Shear, Punch and Coper

THE No. 7 combination shear, punch and coper has been completed recently by Joseph T. Ryerson & Son, Inc., Chicago, Ill., to meet the demand for a large capacity machine handling these various operations. It is built with the same general features as the smaller Ryerson combination machines designed for similar work.



Ryerson No. 7 Combination Shear, Punch and Coper

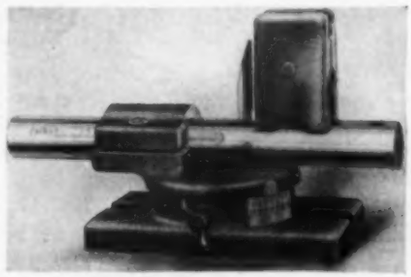
The punch is capable of handling almost all of the varieties of structural shapes on the market. The operation of this punch is not interfered with in any manner by the other units built into the machine. The shearing end of the machine is constructed so that a single slide handles the shearing of angles, bar cutting, plate shearing, and coping. The angle-shear attachment handles both inside and outside miter cutting as well as straight shearing. The blades in this unit are made in sections for economical and easy replacement. Bar-cutting blades are located directly below the angle-shear blades. The full range of rounds and squares is handled by one set of blades, a real economy.

The punch attachment has a 24-in. throat and a capacity for punching $1\frac{5}{16}$-in. diam. holes through 1-in. plate. The plate shear will handle, $\frac{3}{4}$-in. material of any length or width. Other capacities include flat-bar shearing 7x1 in.; round bars, $2\frac{1}{4}$ in. in diameter; square bars, 2x2 in.; angles, 6x6x$\frac{1}{2}$ in.; angles in miter 4x4x$\frac{1}{2}$ in., and notches in 4x4x$\frac{1}{2}$ in. angles.

"Geometric" Universal Chaser-Grinding Fixture

The Universal chaser-grinding fixture offered by the Geometric Tool Company, New Haven, Conn., is used to grind chasers on both the cutting face and chamfer.

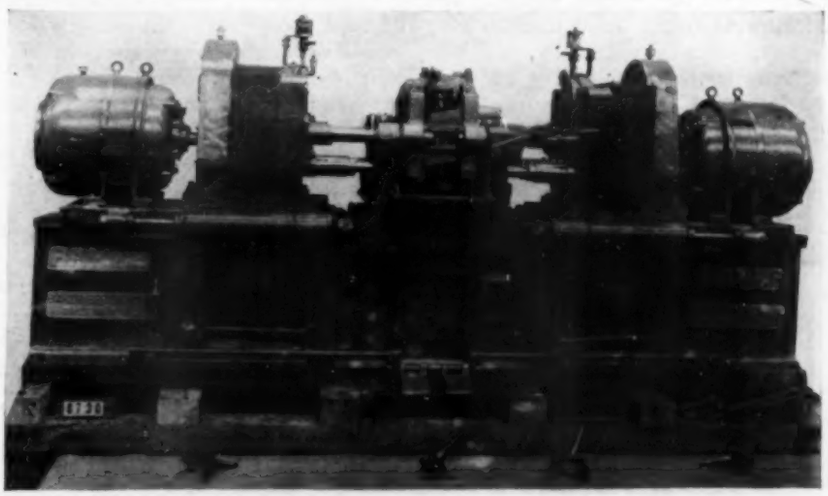
Milled chasers, tapped or hobbed diehead chasers, collapsing - tap chasers, all may be reground with equal facility on this fixture, which will thus produce a flat chamfer, a concave chamfer, and a convex chamfer, respectively. The cutting faces of all these different types of chasers may also be reground on the same fixture, which may be used on any Universal surface grinder.



Geometric Universal Chaser-Grinding Fixture

Baker Improved No. 25 HH Horizontal Boring Machine

AN ADAPTATION of the No. 25 HH two-way, heavy-duty hydraulic-feed machine, manufactured by Baker Brothers, Inc., Toledo, Ohio, is shown in the illustration. This machine is equipped for drilling the kingpin hole in steering knuckles.



Baker Improved No. 25 HH Horizontal Boring Machine

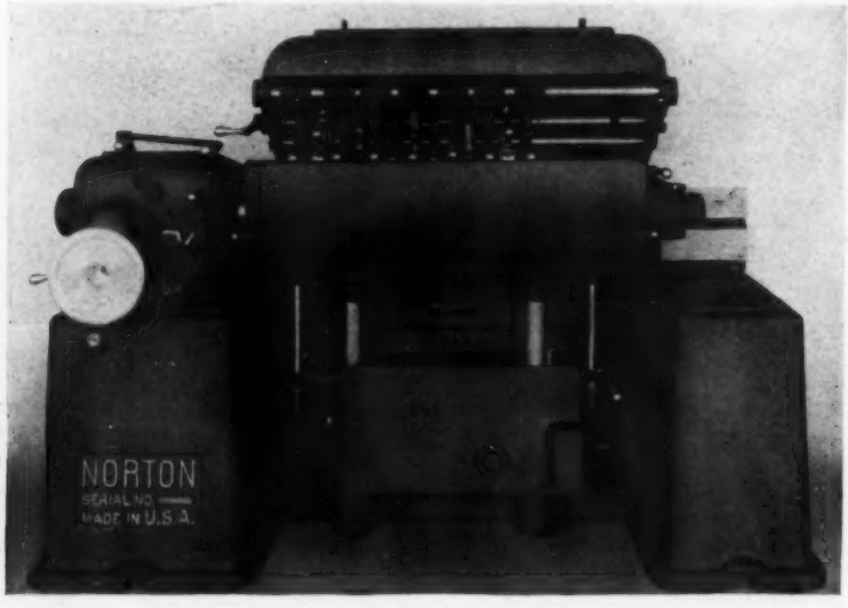
Two steering knuckles are chucked, and drilled simultaneously from the two ends. The fixtures shown are of the stationary type, but the same machine can be furnished with a 180-deg. indexing fixture, which allows of the chucking of two knuckles while two others are being drilled.

This machine is furnished with two motor-driven Oilgear pumps, so that the full benefit of oil-feed is secured without geared equalizing mechanism. Each opposed two-spindle head is arranged with individual direct connected motor-drive, provision being made in the head for gearing for securing different speeds at the spindles. The spindle heads are made separately from the saddle so that different centers can be adapted to the standard end units, depending upon the clearances required between spindles.

Norton Type 50 Crankshaft Lapping Machine

SEVERAL improved features are contained in the Type 50 crankshaft lapping machine of the Norton Company, Worcester, Mass. One of the principal improvements is the mechanical elevating table for raising and lowering the work. The crankshaft is placed on supporting blocks on a table 28 in. from the floor and raised mechanically into proper alignment with the headstock and tailstock. The shaft is located instantly with the driving pin. When the operation is finished, the shaft is mechanically lowered clear of the lapping arms for inspection. The lapping time is also mechanically controlled. The mechanism is set to lap a specified time, and, when this period has elapsed, the work stops so that each shaft is lapped a predetermined amount of time, insuring ease of operation and greater uniformity of finish and surface.

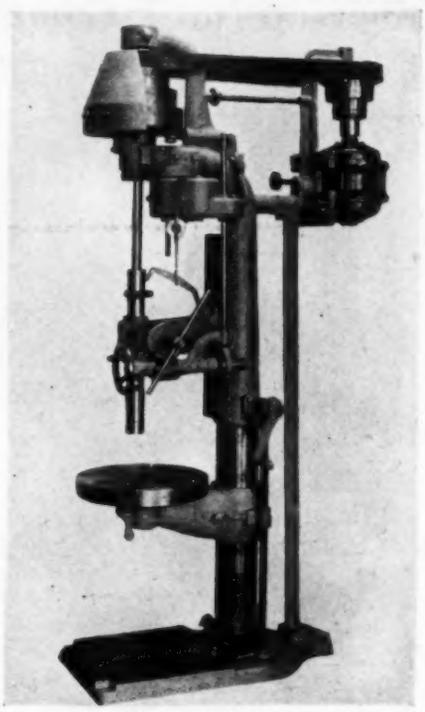
The lapping arms are now counterbalanced and suspended from a vertical position so that the weight of the lapping arm mechanism has no influence on the lapping action. The arms, with minor adjustments, may be adapted to any crankshaft. The machine is designed to lap all main bearings and crankpins at the same time. It has a capacity for crankshafts up to 42 in. in length. Abrasive paper, cast iron laps with loose abrasive, or abrasive sticks may be used. The machine is entirely self-contained and is fully equipped with ball and roller bearings.



Norton Type 50 Crankshaft Lapping Machine

"C-O" 21-Inch Sliding-Head, Backed-Geared Sensitive Drill

Manufactured to drill to the center of a 21-in. circle on the gib and capable of handling work 23-in. in diameter, the C-O 21-in. sliding-head, back geared, self-feed drill, now offered by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill., is equipped with motor drive similar to the 15-in. machine, described on page 524 of the present issue. The machine has a similar motor, similar bearings, and similar belt-tightening attachments. The back gears on this machine are confined within a cone pulley, are made of steel and bronze, and are engaged or disengaged by a single-lever control. Four changes of feed are provided in the self-feed mechanism which is simple in construction. The machine allows a 12-in. spindle travel and 16½-in. vertical adjustment of the head. The spindle



"C-O" 21-Inch Sliding-Head, Back-Geared Sensitive Drill

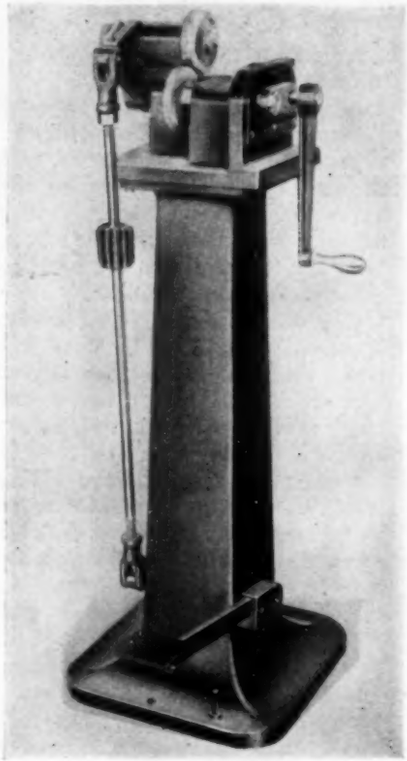
will take a No. 4 Morse taper shank, and will handle drills up to 1½-in. in diameter. The table is 17 in. in diameter. Spindle speeds varying from 260 to 1,580 with backgear out, and from 73 to 425 r.p.m. with backgear in, are provided. Floor space required is 17½ x 43-in. A 1-hp. motor is used. The weight of this machine is 890 pounds.

Noble & Westbrook No. 41 Rotary Graduating Machine

This machine, placed on the market by the Noble & Westbrook Manufacturing Company, 20 West Brook St., East Hartford, Conn., is used for graduating and numbering micrometer collars in sizes up to 3½ in. in diameter. Any size of collar can be marked without the use of special gears, but a special die is required for each size of collar. With the use of this equipment, the collar is graduated completely by a couple of turns of the handle.

In the operation of this machine, two spindles, which are easily adjustable from 0 to 3½ in., and which are controlled and kept in position relative to each other by special, accurate

gearing, are the basic elements. The machine can be had for hand operation on small-lot production, or a bracket can be installed for mounting a clutch and motor, where production



Noble & Westbrook No. 41 Rotary Graduating Machine

operations are encountered. The machine occupies a floor space of 18x18 in. and its height is 40 in. The weight is 200 pounds.

Hill-Curtis Type F-B, Electrically-Driven, Railroad-Journal Wedge Reclaimer

The F-B journal wedge reclaimer recently introduced by the Hill-Curtis Company, Kalamazoo, Mich., is a simple, rugged device for accurately and quickly grinding the correct radius on both new and worn journal wedges. It consists of a profile block, the top of which is machined to the correct radius for journal wedges. On this machined surface a chuck that will hold all standard A.I.A. wedges is fitted. This chuck, with journal-wedge locked arm, projects toward the front of the machine and is guided under the wheel by means of a feather key which fits in guiding slots planed in the top of the profile block. After one section of the wedge radius is ground the chuck is moved over on the profile block until the feather-key in the chuck slides in the next slot. This operation is repeated until as much of the surface of the wedge is ground as is necessary to reclaim the correct radius.

The amount to be ground from the wedge is controlled by the handwheel at the extreme right of the machine. This handwheel operates the screw that moves the adjusting block between the profile block and the base of the machine on an inclined way, thereby raising and lowering the wedge in relation to the grinding wheel. The whole wedge-reclaiming end of the machine can be raised and lowered by means of a vertical screw and handwheel, to compensate the wear.

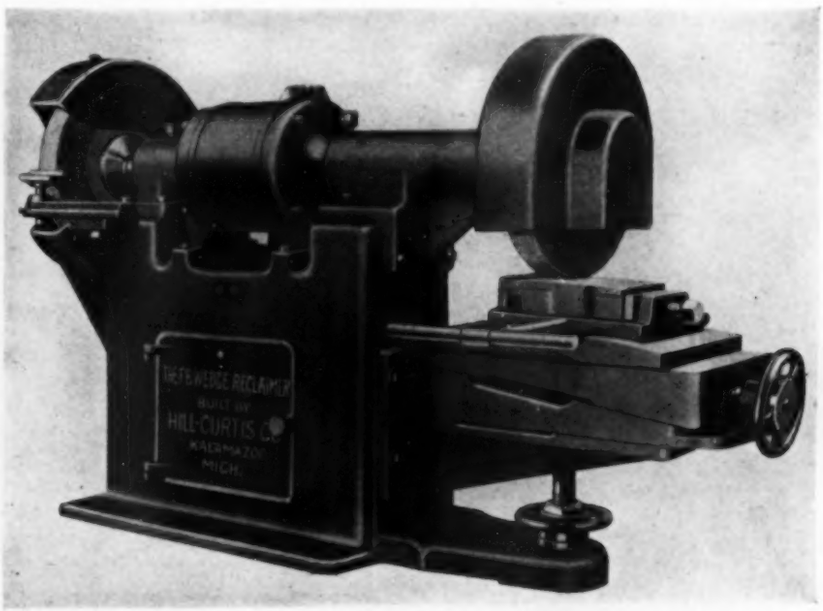
The right-hand side of the machine is fitted with a concave grinding wheel of a grade and grain best adapted for the grinding of journal wedges. The left-hand side is designed for a straight-faced wheel, 18 x 3 in., for tool and production grinding.

All spindles of the machine are made of nickel-steel accurately ground and balanced. Oversize ball bearings, or Timken tapered roller bearings are optional. These bearings are mounted in end caps in close proximity to the grinding wheels. They are completely inclosed and protected from dust and dirt by double labyrinth seals. Wheel guards are made of steel and comply with all safety codes. These guards are fitted with removable end covers for quick access to the grinding wheel.

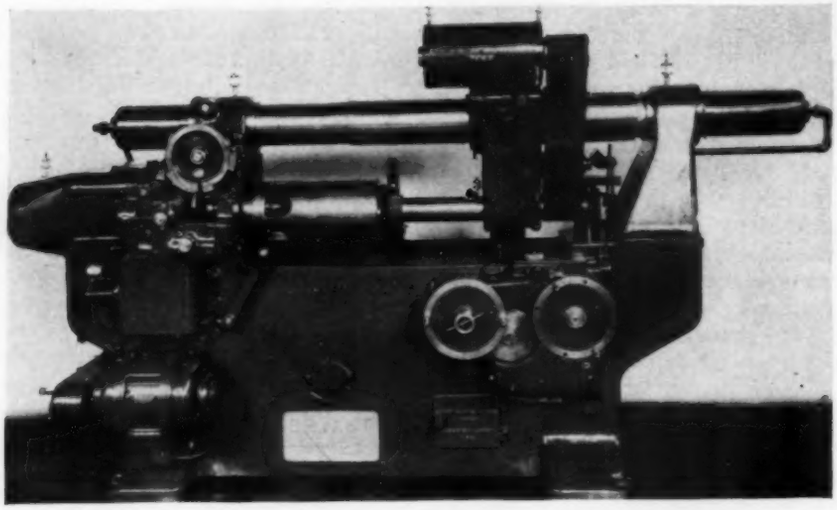
The motor is of 5 hp. capacity, specially designed for this service. It will withstand a momentary overload up to 100 per cent beyond its rated capacity without heating over 40 deg. Centigrade. It is totally inclosed, and is ventilated by a current of air passed through an air cleaner before it enters the motor windings. An automatic motor starter in the pedestal, having a conveniently-mounted push-button remote control, is standard equipment. This device offers protection from low voltage, overload, and phase failure.

Bryant No. 3 Heavy-Duty Grinder

A heavy-duty model of its No. 3 semi-automatic hole grinder has been developed by the Bryant Chucking Grinder Company, Springfield, Vt., to supplement its No. 3 standard machine which was limited to 1-in. holes. The heavier machine grinds holes up to 2 in. in diameter, but



Hill-Curtis Type F-B, Electrically-Driven, Railroad-Journal Wedge Reclaimer, for grinding radius on journal wedges



Improved Bryant No. 3 Heavy-Duty Semi-Automatic Hole Grinder

the stroke and swing remain unchanged. A heavier slide-bar, larger drive-shaft, wider belts, and larger motor equipped with Texrope drive are employed to provide for the increased capacity. In general appearance the machine is similar to the lighter model.

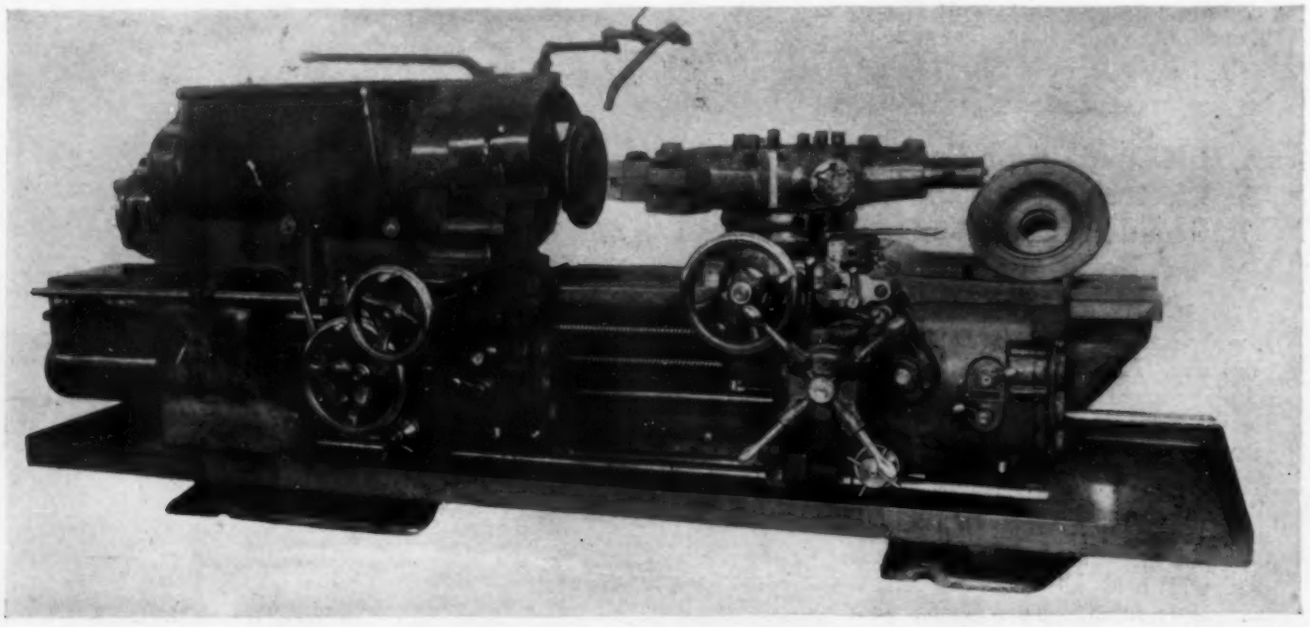
"Libby-International" Type H Cross-Sliding Turret Lathe

THE influence of the new alloy steels used in manufacturing and of tungsten-carbide tools used for cutting them, is shown in the "Libby-International" Type H cross-sliding turret lathe manufactured by the International Machine Tool Company, Indianapolis, Ind. This machine is a very heavy, powerful machine. The bed and headstock are a one-piece casting of nickel-chromium alloy iron, under this is the oil pan which is cast integral with the legs, adding rigidity to the machine. Strips of hardened steel are dovetailed into the ways, giving a continuous hardened way without the use of screws. All gearing is made of alloy steel, heat-treated, and has Maag teeth. A total of 77 sets of anti-friction bearings are used.

The drive is direct, the motor being mounted on the primary driveshaft through a flexible coupling. The aprons are one-piece castings with gears running in oil. A positive lock is provided for the leadscrews, which allows the carriages to be returned by rapid traverse when chasing threads. The rapid traverse mechanisms for the carriages are independent and the feeds also.

The design of the clutch has been improved to hold the work rigid under the heavy cutting possible with the new cutting alloys, and a brake stops the spindle instantly when the clutch is thrown out.

The specifications of the 1H size, which is next to the smallest, are as follows: Swing over ways, 24 in.; swing over carriage, 22½ in.; hole in spindle, 6¼ in.; travel of turret carriage, 44 in.; travel of toolpost guide, 40 in.; chuck diameter, 18 in.; horsepower of motor, 10 or 15; range of feeds, 0.007 to 0.500 in.; size of toolpost tools, 1x1⅛ in.; number of screw cutting change gears, 9; threads that can be cut per inch, 2 to 32; number of spindle speeds, 8; spindle speeds, 10 to 220 r.p.m.

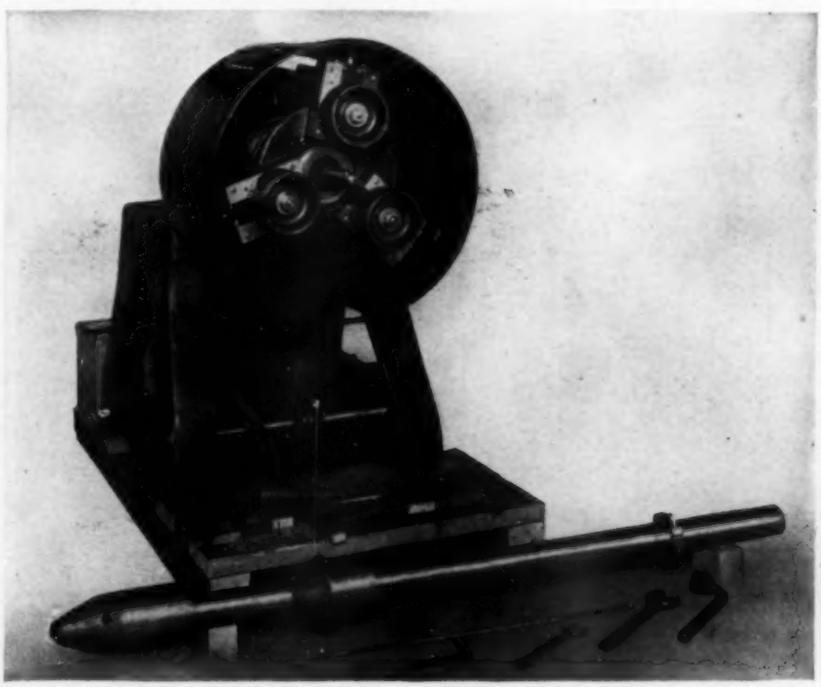


Libby Type 1 H Cross-Sliding Turret Lathe

Ryerson Flue Roller for 1½- to 6-Inch Tubes

THE flue roller introduced by Joseph T. Ryerson & Son, Inc., Chicago, Ill., is another addition to the company's line of flue-shop equipment. This machine rolls down the weld of the tube and safe-end after they have been welded together, by using the welding heat without reheating. The cast frame of the machine supporting a large hollow cylinder rotated by silent-chain drive from a 5-hp., 1,200 r.p.m. constant-speed motor. On the front of the rotating cylinder are three idler-rollers each 120 deg. apart, and adjustable in or out from the center by means of a separate screw and slide arrangement. The slide supporting the rollers is linked with three toggle-levers which receive movement while in rotation by means of a slide-collar and an air-cylinder mechanism. A stationary mandrel supports the tube in the center of the rotating cylinder and carries at the center of the welding rollers a welding former for each size of tube to be welded. The mandrel, in turn, is supported by a bracket in the back end of the machine and also by a sliding-support bushing, which is adjustable in the rotating cylinder to accommodate various lengths of safe-ends.

In operation, the tube with its safe-end is pushed over the welding former to length so that the weld is directly under the rollers. These are then brought down on the heated weld by means of a foot-valve which operates the air-cylinder. The rotating of the head revolves the roller around the weld, smoothing it down on both the outside and inside of the tube. This machine will weld tubes from 1½ to 6 in. in diameter.

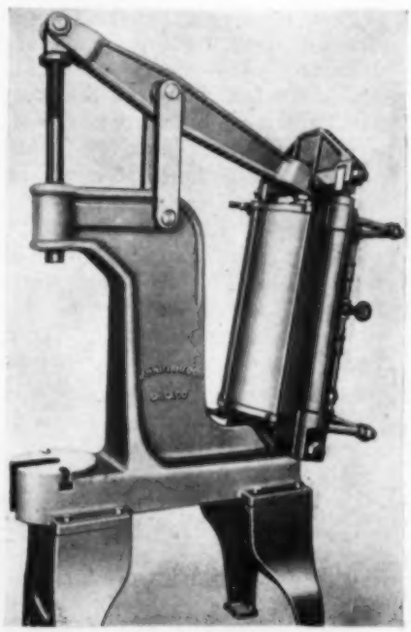


Ryerson Flue Roller for 1½ to 6-in. tubes

Hannifin Hydro-Pneumatic Broaching Press for Short Holes

A RAPID method of broaching comparatively short holes has been developed by the Hannifin Manufacturing Company, Chicago, Illinois.

It has been impossible to use air-operated presses heretofore for broaching operations because of the great speed at which the ram travels, causing the broach to plunge into the hole and resulting in breakage of the broach. This objection to the otherwise speedy air-operated press for broaching has been overcome by application of hydraulic speed control. As will be noted from the illustration, the control consists of two small cylinders mounted on either side of the air-operated power cylinder. Speed control is accomplished by regulated transfer of oil from the top to the bottom of the oil control cylinders. During the power stroke the oil passes through a needle valve, which can be regulated to secure any desired speed. During the return, or idle stroke the oil passes through a swing check, thus permitting the ram to return to the top at full speed.



Hannifin Hydro-Pneumatic Broaching Press

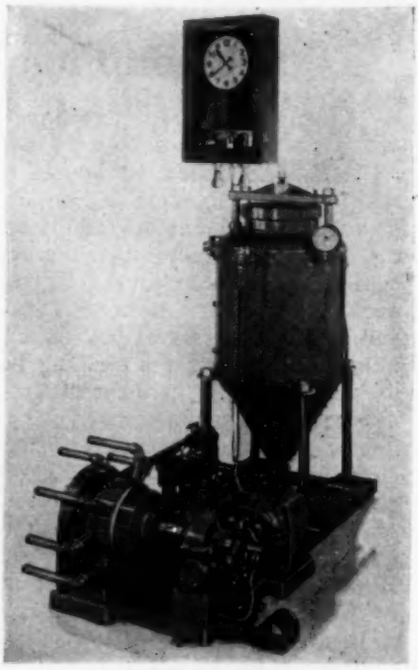
The oil cylinder speed control results in uniform travel of the ram at any predetermined speed without loss of power. The press is not designed for broaching operations that require long broaches. Short holes, which can be finished with broaches not exceeding 12 in. in length, can be broached. The T-slots in the bed permit attachment of fixtures.

Monarch Hydraulic Automatic Lathe

THE Monarch Machine Tool Company, Sidney, Ohio, has announced the hydraulic automatic lathe illustrated, and designated as No. 3. Both front and rear carriages can be equipped with length-feed and quick-traverse, the tool slides being similarly operated. The complete cycle of both carriage and tool slides is automatic and all controls are hydraulic. Diameter and length stops are adjustable and positive. Feeds can be changed quickly and an automatically varying rate can be secured.

The headstock unit is a separate casting with Timken bearings. A multiple-disk driving clutch takes its power from the motor mounted in the base, driving the spindle through a worm. Pick-off gears on the front of the headstock provide a quick means of securing any spindle speed desired. All working parts dip in oil. A coolant pump of 80-gal. per min. capacity is mounted in the headstock housing and is driven from the main motor. One starting lever spindle controls coolant and hydraulic feeds on both carriages.

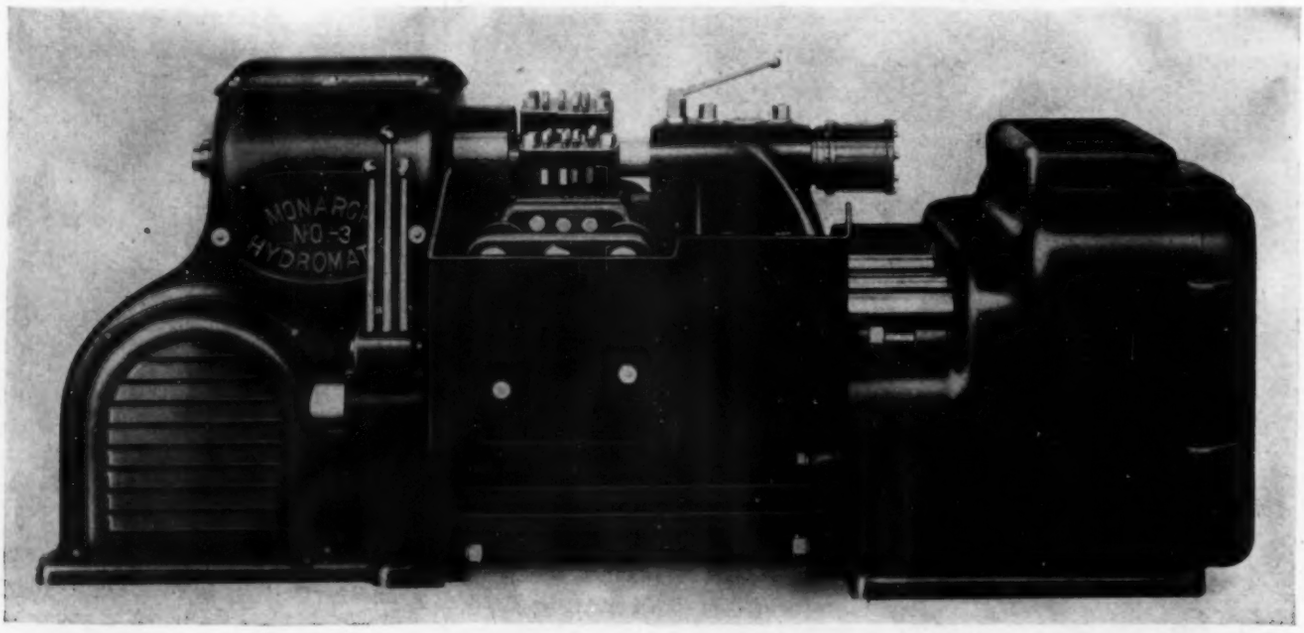
The middle section is the cast-iron chip and coolant reservoir. It is keyed and bolted to the headstock and tail-end housing. The tail-end housing contains the hydraulic mechanism that is easily accessible. A 2-hp. motor in this housing drives the two Oilgear hydraulic pumps. The carriages slide on round steel bars. The two inside bars are anchored in head and tail end housing. The carriages clamp on the two outside bars, which slide in bushings in the head and tail housings. A positive, easily adjustable length-stop determines the length of carriage travel. The toolslides are supported on two round hardened-steel bars and have split taper adjustable bushings to compensate for wear. The cross-feed hydraulic cylinder is placed in the toolslide between the bars. A diameter-stop determines the depth of cut and the cross-tool travel of the toolslides. Either toolslide can be reversed instantly and returned to the starting position from any point in the cycle. The tailstock clamps on the two inside bars. Its spindle can be controlled manually, hydraulically, or by air. Any desired spindle speed up to 800 r.p.m. is available.



"Pneuma-Lectric" Lubricating Equipment

Keystone "Pneuma-Lectric" Lubricating System

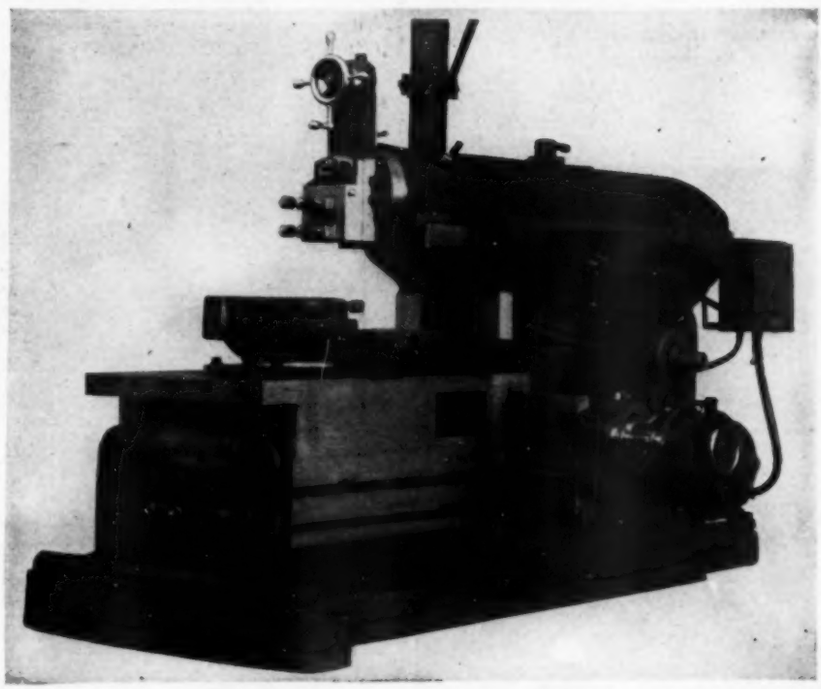
For the delivery of grease to a rotary distributor and thence to various lines leading to bearings in a machine, the "Pneuma-Lectric" lubricating system has been placed on the market by the Keystone Lubricating Company, 21st, Fairfield, and Lippencott Sts., Philadelphia, Pa. The distributor is operated by a motor controlled by a "Tork" electric clock adjustable for operation at intervals of once in five minutes to once in 24 hours. The entire equipment is mounted compactly on a sturdy base.



Monarch Hydraulic Automatic Lathe

Ohio 36-Inch "Super-Dreadnaught" Shaper

OFFERED particularly for large work which must be clamped down, the 36-in. "Super-Dreadnaught" shaper has been announced by the Ohio Machine Tool Company, Kenton, Ohio. The device can also be used for small work, since the machine is not difficult nor clumsy to operate because all levers are within a 12 in. radius. The machine is capable of "hogging off" or taking the finest finish cuts at high speed without vibration.



Ohio 36-Inch "Super-Dreadnaught" Shaper

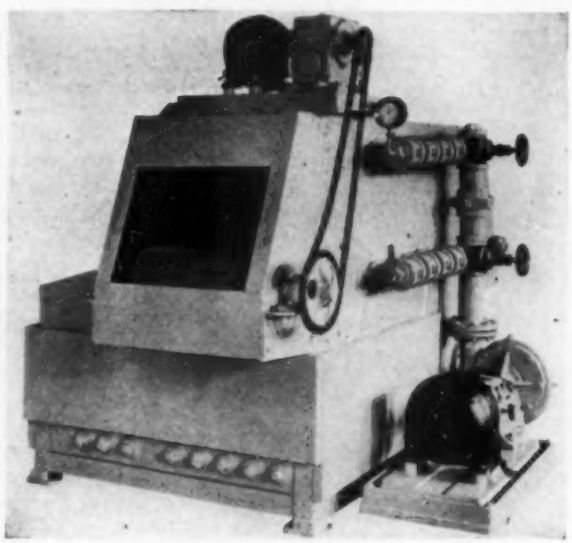
Consideration has been given to the range and working capacity under the ram, the size of the table top, the length of the ram remaining in the column, which is 56 in., even on extended strokes, and the ram gibbing to take care of both lateral and vertical thrust. The ram is of the double-wall, box-section type and permits a head with a 13 in. diam. swivel. The regular box table has a top surface of 36 x 20 in., including the saddle. Since there is considerable overhang in a table of this type, a very heavy table support is furnished equipped with a regular table jack manufactured by the company. This jack equalizes the weight between the rail and the table support, thereby preserving the alignment and saving the back of the rail from undue wear. A drop table can also be used advantageously where a greater distance between the ram and the table surface is required. The maximum distance between the regular table and ram is 22 in. while by the use of a drop table this distance can be increased to 30½ in. A swivel block can be utilized to fill in the drop table when the surface of the regular table is required.

Regular features include automatic forced-feed lubrication, instantaneous feed, quick-change speed box, clutch and brake, micrometer collar 5 in. in diameter on the head, bullgear hub cast integral, and adjustable tapered gibs incorporated at the top and side of the ram bearings to compensate for wear.

The regular equipment includes double or single screw vise, tables, herringbone bullgear and pinion, steel crankarm, table support and jack, spoked handwheel and head, double-wall box-section ram, heavy-ribbed column with ram bearing 56 x 15 in., large head on ram, with 13 in. diam. swivel, and base reinforced box-section type. Extra equipment includes automatic power downfeed to the head, rapid power traverse, power elevation, revolving table 30 in. long by 20 in. wide, and tilting top on table, 30 in. long by 20 in. wide. The machine illustrated is fitted with an extra large table.

Colt Autosan, Two-Tank, Conveyor-Type, Metal Parts Cleaner

Embodying many of the features of the regular Colt line, an improved metal parts cleaner will be exhibted by the Autosan Machine Division of the Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn. Among the features are: unusually large capacity, a cleaning solution recirculation system, constant, exact, control of water and pressure both above and below parts being washed, and accessibility of tanks, solution, and moving parts. The conveyor is constructed of a specially woven material adapted for use in cleaning smaller parts which require laying directly on the conveyor, at the same time allowing complete cleaning of the parts by not hampering the force of the water sprayed from the jets.



Colt Autosan Metal Parts Cleaner

Landis Automatic Bolt-Forming and Threading Machine

CERTAIN features, notably an escapement attachment and a rear delivery conveyor, have been added to the Landis automatic forming and threading machine made by the Landis Machine Company, Waynesboro, Pa., and designed to point and thread bolts of $\frac{5}{16}$ to $\frac{3}{4}$ in. in diameter and 1 to 6 in. in length.

As shown in Fig. 1, the bolt escapement is built at the end of the magazine. It is designed to release one bolt at a time from the magazine, thus relieving the bolt to be transfered to the chuck turret of the weight of other bolts in the magazine, and preventing interference of bolt heads.

The conveyor, shown in Fig. 2, is perforated and has an oscillating motion to move the bolts slowly toward the handling boxes. During the bolt travel most of the coolant drains off of the bolts, is collected in a trough under the conveyor, and returns to the sump in the base of the machine. Small chips, separated from the bolts, drop through the holes in the conveyor and are separated out. The conveyor shown is for rear delivery but front delivery can be provided.

Fig. 2—Landis Bolt Threader. In right corner, the rear delivery conveyor

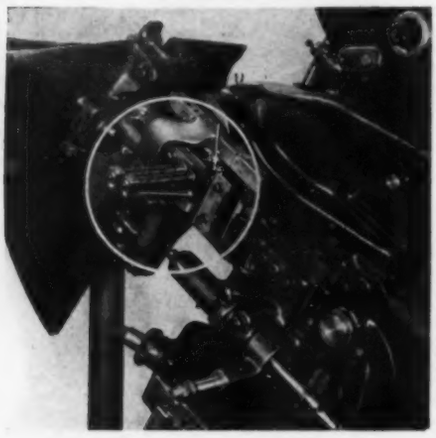
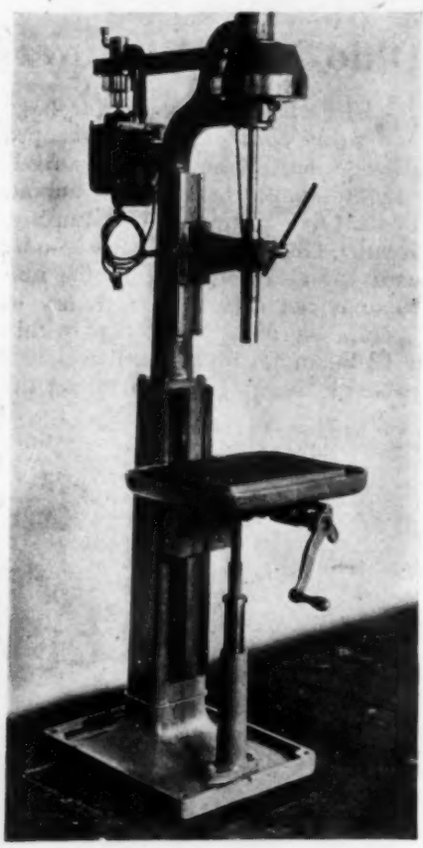


Fig. 1—Escapement mechanism in circle

"C-O" 15-Inch Sliding-Head Sensitive Drill

The 15-in. sensitive drill, made by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill., is mounted on a box-type column with an oil-grooved table, and is designed and constructed to give accuracy and speed in drilling holes up to ½-in. in diameter. The spindle has a ball-thrust bearing and is supported by a sleeve with long bearings. The cone pulley rotates on Timken bearings. The table is heavily reinforced, has a large oil groove, and is mounted on a screw-jack for adjustment.



"C-O" 15-Inch Sliding-Head Sensitive Drill

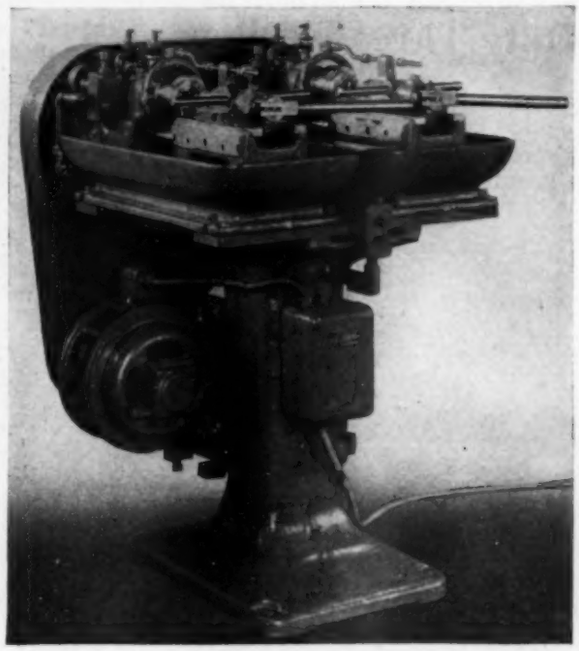
Idlers, pulleys, intermediate cone-pulleys and twisting and turning of the belt are eliminated by attaching the motor in the manner shown in the illustration. The motor is of the type which can be serviced universally. A simple belt tightener is provided by means of a sliding member to which the motor is attached. This unit is securely locked in place by a tension screw. The drill comes equipped with necessary lighting cords, and toggle switch. Speeds vary from 400 to 10,000 r.p.m., and the drill weighs 505 pounds.

"H & G" Threading Machine

The "H & G" threading machine manufactured by the Eastern Machine Screw Corporation, New Haven, Conn., has been improved by

the addition of an oil reservoir and has been enlarged to provide more chip room. The machine is made in several types, comprising a pedestal-base machine, a bench machine, a double-spindle machine, a motor-and-Texrope-drive machine, and a motor-and-chain-drive machine. Several bench machines may also be mounted on one base to build up a multiple-spindle threading machine.

The spindle and collet slide takes a wide range of work. An open-side jaw slide is available for long rods. The machine may be equipped with $\frac{7}{16}$-, $\frac{9}{16}$- or 1-in. heads and has a capacity of 11 threads per inch and under. With motor drive, the machines have somewhat greater capacities. They have a 1-in. hole in the spindle for 9 in. length of threading. Bench machines occupy an area 14x35 in., and pedestal-type machines occupy a floor space of 18x35 inches. Shipping weights are 450 and 650 pounds.



"H & G" Threading Machine

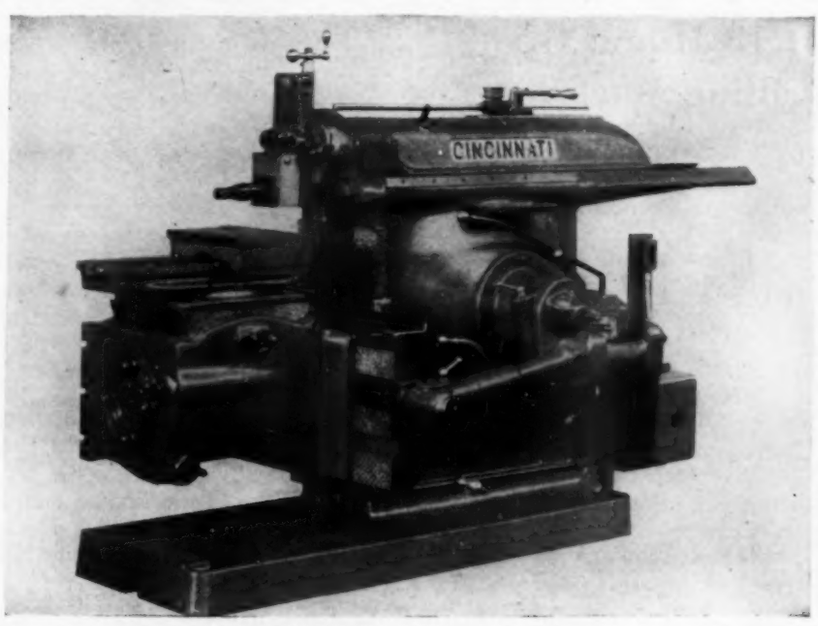
Cincinnati Heavy-Duty Shapers

TWO shapers are being introduced by the Cincinnati Shaper Company, Cincinnati, Ohio, a 24-in. heavy-duty shaper, and a 16-in. heavy-duty shaper. Both machines have a built-in power rapid traverse to the table.

The 16-in. shaper is equipped with the "Cincinnati" universal table, which is a revolving table with a tilting top, without hinges, jacks or table support. Cutting speeds have been increased, giving it the highest number of strokes per minute of any shaper ever built by the company.

A combination tool tray and cross-rail guard are features, as well as Timken thrust bearings on each end of the cross-feed screw. Another feature of this shaper is the construction of the ram bearings. These now extend to the end of the ram and reduce overhang from the cutting tool to the ram bearing by $2\frac{3}{8}$ inches.

These features are also built into the 24-in. heavy-duty shaper, which is equipped with a full box table. Heavy, accurate, cutting without chatter is claimed for the machine.



Cincinnati 24-Inch, Heavy-Duty Shaper

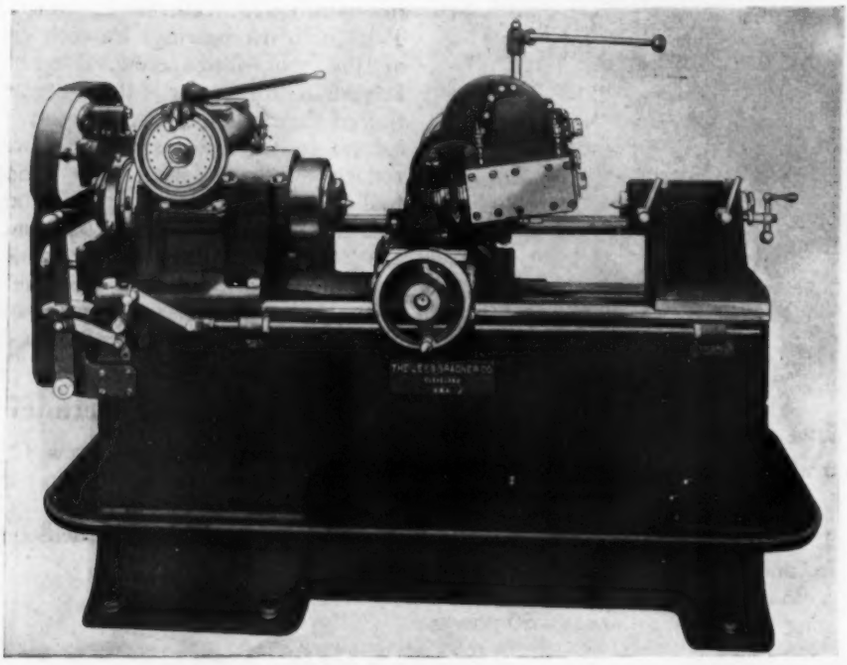
"H & G" Chaser Grinder

The Eastern Machine Screw Corporation, New Haven, Conn., announces improvements in its "H & G" chaser grinder. This machine is now furnished with a pedestal mounting and with means for motor drive, the motor being concealed in the pedestal. The wheel on the left of the machine grinds the throat of the chaser. The wheel on the right of the machine grinds all four cutting faces at once.

"H & G" Chaser Grinder with Pedestal Base

Lees-Bradner Heavy-Duty Thread Miller

A HEAVY-DUTY thread milling machine is being offered by the Lees-Bradner Company, Cleveland, Ohio. The principal feature of this machine is a two-speed cutter head with a reduction in the head, a quick-change lever permitting a roughing cut and returning for a finishing cut at one setting of the work. A quick-change cutter reverse mechanism is located between the drive shaft and the cutter head, facilitating the change of direction of cutter rotation. This head, which has interchangeable cutter spindle units, is rigid in construction. The leadscrew is covered.



Lees-Bradner Heavy-Duty Thread Miller

"Natco" Models D 13 H and C-5 Multiple-Spindle Drilling Machines

TWO machines, one the model D 13 H multiple-spindle drilling machine, and the other the model C-5 multiple-spindle drilling and tapping machine, have been placed on the market by the National Automatic Tool Company, Richmond, Ind. The model D 13 H multiple-spindle machine illustrated in Fig. 1, is of medium size, and is equipped with hydraulic feed. The model C-5 is a small sensitive driller with either hand or foot feed and may be equipped with a tapping attachment if desired.

The base of the model D 13 H is exceptionally deep and has ribs running both lengthwise and crosswise. The column is very heavy and is of the box-section type. The ways that support the head are 12 in. across and have a bearing 2½ in. wide and 1¾ in. deep. There are large openings in the rear of the column for adding auxiliary counterweights, and an oil reservoir for the hydraulic system is located in the column near the top.

Three sizes of heads have been designed for this machine. They are 12x18 in., rectangular bored, for 24 spindles, 16x24 in., rectangular bored, for 22 or 12 spindles, and 18 in., round bored, for 12 spindles. The latter two are of the heavy-duty type and are of standard "Natco" design, having the patented independent change of speed to each spindle or a single speed, if desired. Either type has a neutral position for the spindles not in use. All gears are hardened and run in oil. The joints are of the improved self-oiling design and are constructed of alloy steel, hardened and ground throughout. Two T-slots are machined in the flange of the head for attaching the spindle and arm equipment.

An adjustable knee-type table is supplied. The minimum height of the working surface is 22 in. with 17¼ in. adjustment. The table is raised or lowered by means of a removable crank. The knee is supported by a long bearing on the column and by the adjusting screw which is located directly under the center of the working area. The working surface of the table is 23x40 in. and two T-slots run lengthwise of the table for clamping fixtures or a rotary table.

Two 5-in., low-pressure oil cylinders give the hydraulic feed and they are mounted in the heavy brackets at the top of the column. The maximum combined pressure for these cylinders is 8,000 pounds and is applied directly to the lugs cast on

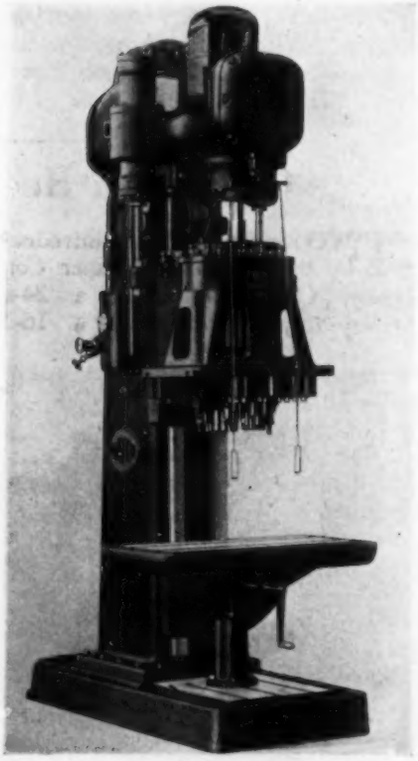


Fig. 1—"Natco" Model D 13 H Multiple-Spindle Drilling Machine

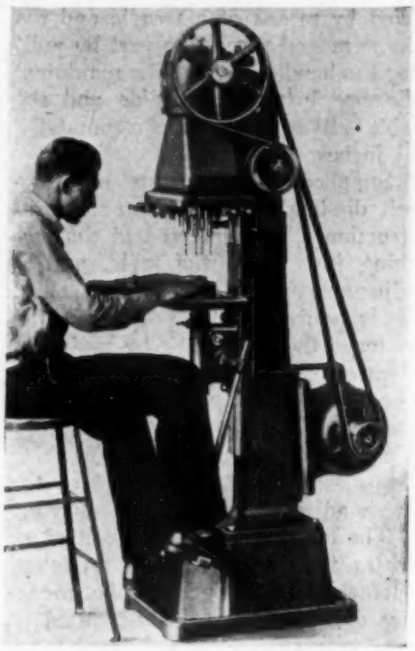


Fig. 2—"Nateo" Model C-5 Multiple-Spindle Drilling and Tapping Machine

the head slide. The control of the feed is simple and positive through two handles within easy reach at all times. At the start of each cycle, it is only necessary to pull one of these handles to start the head travel. Rapid down feed, rapid up, and stop are controlled automatically by adjustable trip dogs located on the left-hand head clamp. If an emergency stop is necessary at any time, pulling the other handle brings the head to a stop, and in turn it automatically returns it to the starting position.

The pump and oil reservoir are located on and in the top of the column respectively, the pump being driven through a gear from the main drive shaft. A constant-speed pump is used and is equipped with a by-pass which allows excess oil to return to the reservoir when a given pressure has been reached. This protects the drills should an unusually hard spot be encountered.

The drive of the machine is furnished directly from the motor. The driving power is applied through a horizontal shaft mounted in ball bearings, to a train of heavy heat-treated alloy steel change gears, then to a set of heavy heat-treated alloy steel spiral bevel gears on the head proper.

The construction of the drill spindle bearing and adjustable arm permits a vertical adjustment by loosening the adjusting nut, which allows the steel clamp bar to rock on the steel fulcrum, and then sliding the spindle bearing on the arm to the proper position, adjusting the screw carried in the strap which surrounds the lower spindle bearing stud, so that it bears against the point of the arm. Two nuts are then tightened. The total vertical adjustment is 2 in. A cascade lubrication system is used to insure positive oiling of the neck at all times.

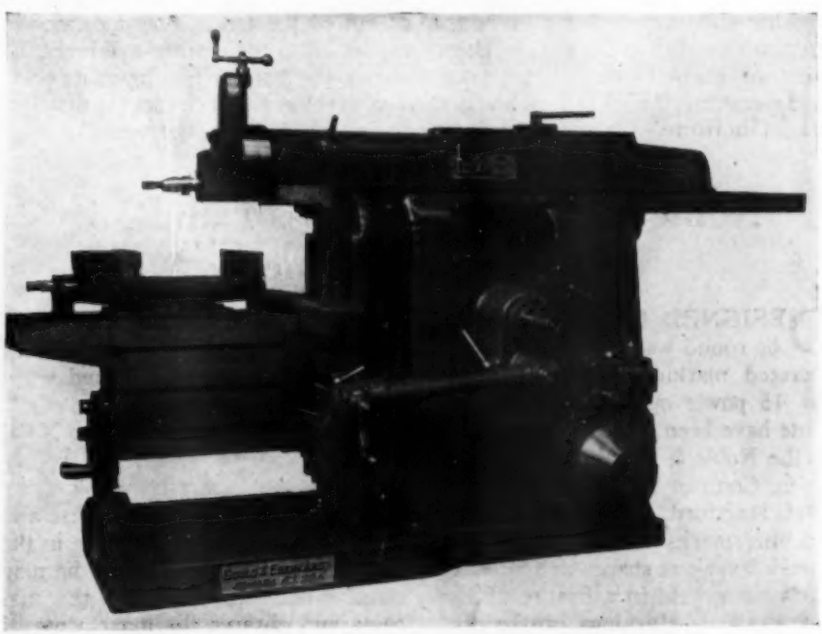
Specifications: Center of head to face of column, 15½ in.; top of base to top of table, max. 39¼ in., min. 22 in.; working surface of table, 40 in. by 23 in.; travel of head, maximum, 19 in.; height of machine, head up, 139 in.; feed, power range, 0 to 15 in. per min.; rapid traverse, 90 in.; floor space, 34x85 in., and weight, 11,500 lb.

The model C-5 multi-driller and tapper is 5 ft. 11 in. high and may be had with either belt drive or belted motor drive. It has a capacity of ten ¼-in. drills in cast iron or ten $\frac{5}{16}$-in. drills in steel, and may be had either with or without a coolant system. The elevation of the table may be obtained through a hand lever or a treadle. The approximate weight is 800 lb., and the floor space required 20x24½ inches.

Gould & Eberhardt 36-Inch Manufacturing-Type Shaper

A 36-IN. manufacturing-type shaper has been added to the line manufactured by Gould & Eberhardt Irvington, N. J. This type embodies the same appointments as found in the other sizes of the line.

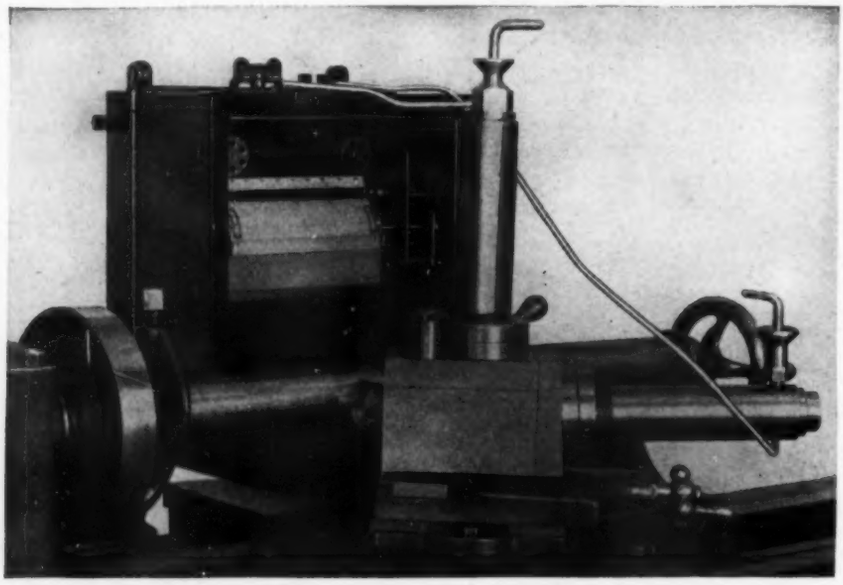
Rapid power traverse may be operated at all times opposite the feed as set. Dual control is furnished for operating the hand feed on the table and at the rail. Improved design of the work slide reduces the table deflection and affords more bearing surface, while providing a more accurate guide. A positive locking device for the table support is applied. A double crank gear transmission with all heat-treated gears is employed, including the two main crank gears. A built-in motor coupled directly to the transmission drive shaft is a feature. A circulatory pressure lubrication system to all important parts, including the linkage system, has been provided. The machine has a symmetrical rigid frame of sturdy proportions and the V-ram guides are made in the 55-deg. chilled type.



Gould & Eberhardt 36-Inch Manufacturing-Type Shaper

Hall "Machinabilimeter"

THIS device from the Hall Planetary Company, Philadelphia, Pa., is designed to test the machinability of metals, the proper form of cutting edge, and the best cutting oil or coolant. It also shows the power used at the cutting edge and the effect of different methods of grinding and finishing tools. It is shown applied to an engine lathe, but can be used on other machines.



Hall "Machinabilimeter"

The metal to be tested is put in the machine and the cutting tool in the instrument is fed to the work. Using a cut of standard depth, one metal can be compared with others, and any lack of uniformity is indicated at all times by the varying pressure on the cutting tool. Hard and soft spots are shown by the gage and recorded on the chart at the rear. Using various lubricants at different points on a bar of uniform quality will frequently show surprising differences in the power required to cut the same material.

The illustration does not show a micrometer indicator that bears against the work to check the depth of cut of the tool. This indicator is connected to the cutting-tool lever. It shows whether the tool holds its position in the cut, and checks the distance the tool is fed into the work.

Noble & Westbrook Nos. 4 and 15 Marking Machines

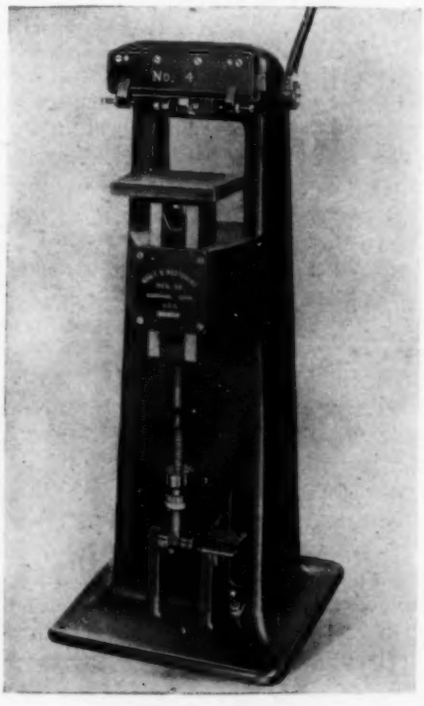
DESIGNED for marking on flat or round work, the No. 4 hand-operated marking machine and the No. 15 power-operated marking machine have been placed on the market by the Noble & Westbrook Manufacturing Company, 20 West Brook St., East Hartford, Conn. The No. 4 machine marks flat or round metal parts of various shapes and sizes, the parts being held in a fixture of suitable design. Markings can be made on this machine that are often 6 in. long. The maximum length of marking on flat work done by the No. 15 machine is 6 in. and on round work 3 in. with a special flat die.

The height of the table of the No. 4 machine is adjustable by a screw. The frame is of extra-heavy construction consisting of a cabinet, base and head. No projecting parts are in the way of the operator, so that he may stand directly in front of the machine and observe the movements of the marking die. The pressure is applied by means of a treadle and the die is moved across the part by pulling the handle down. The maximum distance between the slide and the table is 8½ in., and, under a round die, 6½ inches.

Supplied as a separate unit, the roll die-holder is of improved construction. It is inserted in the machine just above the table, and is adjustable from front to back. The die is returned to the proper position to make the next mark by means of a spring. The die holder can be taken out of the machine without lowering the table. Replaceable bronze bushings and a hardened spindle are also features. The starting point of the die is adjusted with a thumb screw.

The No. 4 machine can be fitted up with a flat die for marking on round surfaces. Both round and flat marking dies can be furnished, fitted in part with changeable steel type, or a holder made especially to take changeable steel type can be supplied. All marking dies, die holders and work holders used with this machine are interchangeable and can be used in the No. 15 machine. The unit occupies a floor space of 18x20 in. and is 48 in. in height. Its weight is 375 pounds.

The No. 15 power-operated machine marks either flat or round metal



Noble & Westbrook No. 4 Hand-Operated Marking Machine

Fig. 2—The No. 15 Power-Operated Marking Machine of the same make

surfaces by the rolling method and uses steel dies. It marks uneven surfaces as well as parts that vary in thickness. The length of marking on flat work is 6 in. and on round work 3 in. with a special flat die. The power is applied through a worm-gear drive by means of a clutch. A single mark may be made, after which the machine stops, or the machine may be arranged to mark continuously. Roller bearings are provided on the die slide to reduce friction.

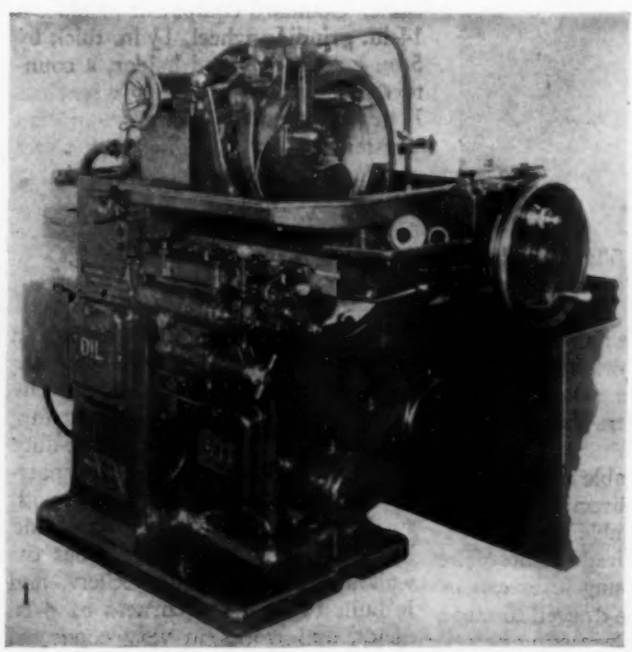
The No. 15 machine is started by pressure on the treadle at the right. A cam thereupon releases the spring pressure, raising the table and making contact between the work and the die. The die next traverses the work. At the completion of the forward stroke, the table drops, the work is released, and the die returns to the first position. Then the machine stops unless it is set to run continuously, in which case the marked piece can be removed and the new one inserted while the die is on the return stroke.

The marking-die holder has a dovetail shank, which permits taking the complete die assembly out of the machine without disturbing the other adjustments. The position of the mark can easily be changed by changing the starting position of the die. This is done through an adjustment knob, which is at the right of the die slide within easy reach of the operator. The die slide has a quick return stroke. Gears and cams run in oil. Provision is made to carry the motor in the base and the machine can be operated as a complete unit, or can be furnished with belt drive. In either case, a speed adjustment of 30 to 40 strokes per min. is obtainable. A 1-hp. motor is ample for ordinary requirements. The machine occupies a floor space of 23x27 in. and is 51 in. high. Its weight is 950 pounds.

Greenfield No. 12 High-Speed Internal Grinder

THE Greenfield Tap & Die Corporation, Greenfield, Mass., has developed a No. 12 high-speed internal grinder that is open-ended, the grinding wheel entering the work from the rear. It is hydraulically-driven, even the valve mechanism and controls being hydraulic in action. The wheelhead is stationary so that it is possible to use a single motor.

The machine swings 15 in., and grinds holes from $\frac{3}{4}$ to $3\frac{1}{4}$ in. in diameter by 4 in. deep. The work-table is $17\frac{1}{4}$x54 in.; cross-slide, 16x41 in.; work-spindle hole $8\frac{1}{4}$ in.; spindle speeds, 214, 383, and 572 r.p.m., but change gears give other speeds.



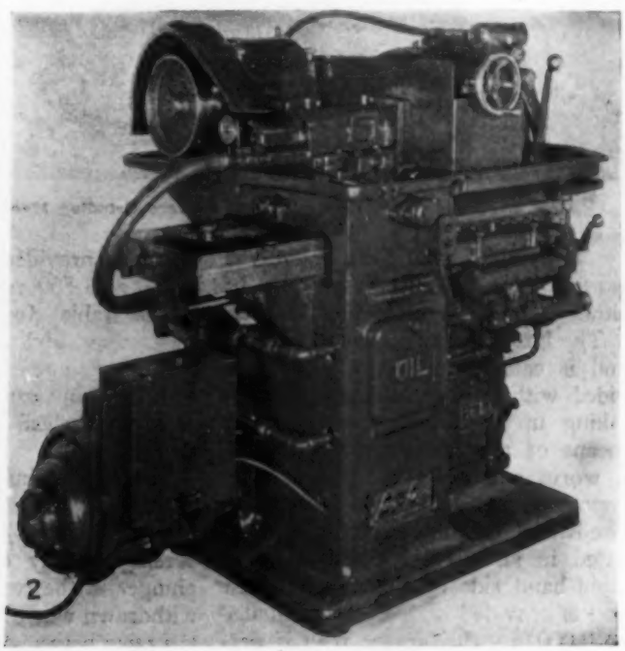
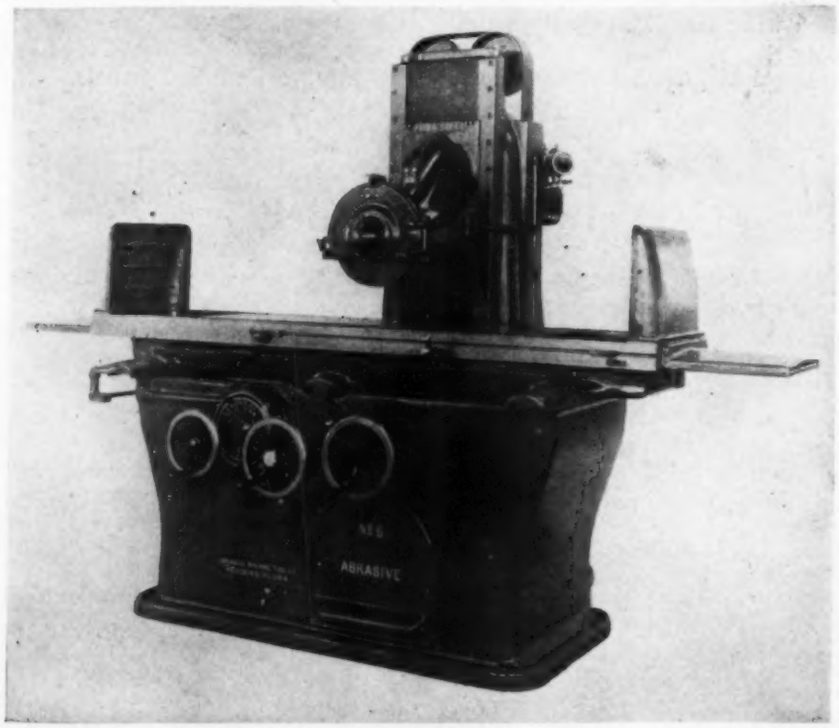


Fig. 1—Greenfield No. 12, High-Speed Internal Grinder, open-end and front-side view. The wheel enters the work from the rear. Fig. 2—Rear view showing single motor drive

The workhead and wheelhead have ball bearings throughout. Hydraulic worktable feed is from 0 to 30 ft. per min. Individual oilers, oil wells and Alemite connections provide lubrication. Either self-contained, single-belt drive or direct-connected motor-drive are provided, a 7½-hp., 1,800 r.p.m. motor being standard. The machine weighs 5,500 pounds.

"Abrasive" No. 5 Surface Grinding Machine

A NO. 5 surface grinding machine, having longitudinal table travel of 48 or 60 in. and an automatic transverse table travel of 14 in., has been placed on the market by the Abrasive Machine Tool Company, East Providence, R. I. The machine uses grinding wheels up to 14 in. in diameter by 1½ in. thick, and 5-in. hole. The work surface of the table may be either 14 by 48 in. or 14 by 60 inches.



"Abrasive" No. 5 Surface Grinding Machine

The head is very massive in design and is carried in square ways provided with adjustable taper gibs for taking up wear. It is actuated by means of a screw operated through a worm and gear, the screw being supported on a ball-thrust bearing. A handwheel for fine adjustment is located in an angular position at the right-hand side of the machine base and is provided with a dial graduated to 0.00025 inch. Power feed is provided, operating at 9 in. per minute up or down, and equipped with adtustable stops, also safety stops. The wheel spindle is of hardened tool steel, running in a large, adjustable, phosphor-bronze box at one end, the rear end being carried on a pair of thrust ball bearings, one on either side of the belt pulley. Thumbscrew adjustment for the spindle and end-thrust is provided. The spindle operates at 1,500 rev. per minute.

The table feed, reversing gear mechanism, and power vertical feed are all combined in one transmission case, and operate in a bath of oil. Spur and helical gears only are employed.

The longitudinal table travel is automatic in either direction, and is provided with adjustable dogs for reversing at any desired point. The plunger in the reversing lever can be withdrawn when it is desired to move the table beyond the reversing points, without changing the position of the dogs. The table handwheel automatically disengages when released. A lever is provided for reversing the table feed by hand. Surface speed of the table is 25 ft. per minute. A hydraulic shock absorber eliminates vibration at the point of table reversal.

The transverse travel of the table is automatic in either direction and the dogs can be adjusted to feed at each reversal of the table or alternate reversals as desired. The range is from $\frac{1}{64}$ to $\frac{14}{64}$ in. The saddle is provided with two flat ways, one at either extremity, and also a center support located directly under the wheel. The saddle can be removed from the machine bed by releasing one screw in the cross-feed nut bracket and removing the gib. The cross-feed screw is equipped with ball-thrust bearings. Adjustable dogs provide for disengaging the automatic transverse feed at any desired point. Safety dogs are also provided to prevent injury to the feeding mechanism.

The machine may be equipped for countershaft or motor drive, the latter by means of a constant-speed motor mounted in the base and directly connected to the main shaft through a flexible coupling. A 5-hp. motor is required, running at 1,150 or 1,450 r.p.m. The floor space required is, transversely, 76 in., and, longitudinally, 188 in. for the 48-in. machine, and 199 in. for the 60-in. machine. Standard equipment includes a 14-in. grinding wheel, 1½ in. thick by 5-in. hole, a diamond holder, a countershaft, and the necessary wrenches. Extra equipment includes an exhauster for dry grinding and a wet grinding attachment.

Elwell-Parker Type EQ Electric Lift Truck

An electric lift truck having a capacity to handle 3,000 lb. has been placed on the market by The Elwell-Parker Electric Company, Cleveland, Ohio. This light-duty model affords a means of transporting two or three skid boxes filled with small forgings or castings or a skid load of tote pans at three times the walking pace of hand truckers, and is built to turn the corners of 4-ft. aisles, and works in very congested quarters. Drive is effected by an inclosed, motor-driven, worm-type

full-floating axle. The frame is mounted on springs. Both controllers and both motors and brakes are accessible.

This truck is but 28½ in. wide by 83 in. long and quite low over the battery compartment, although the controls are retained at the usual height. All moving parts are kept well inside the heavy, curved outer shields that take the bumps characteristic of materials handling operations. A few large bolts and rivets have been employed in the construction, but welding is employed at many places.

Fig. 1—Elwell-Parker Type EQ Electric Lift Truck which has a capacity of 3000 pounds

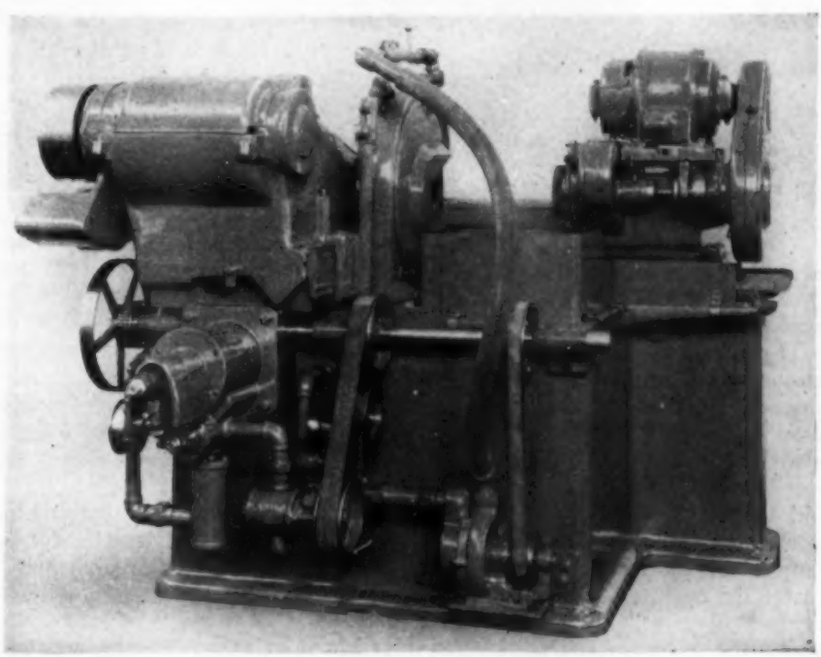
The lift platform is a single ⅜-in. plate bent and welded into a rigid skid support, which is nosed so that it may be eased under a loaded skid from an angle. The platform is backed at the rear with a heavy skid bumper. The present standard size of the platform is 18x41 in., and the height is 7 in., the lift being 3½ inches.

Timken bearings are employed on the steerable train wheels. Practically all steering connections are of the ball and socket type. Steering handle is on the operator's left and is of the vertical or "pump-handle" type being pushed down to steer in the direction wanted.

The travel controller is mounted in front of the operator and actuated by a handle which is removable. Operation of the truck is only effected, however, when the operator stands on the two pedals or the divided platform. One pedal unlocks or locks this controller as the operator steps on or off. The other pedal releases the brake when depressed.

Norton Type A 10-Inch Cylindrical Grinding Machine

Few changes have been made by the Norton Company, Worcester, Mass., in the front of this machine, for the hydraulic mechanism introduced is at the rear near the wheel slide, although it is operated by a lever at the front of the machine. This mechanism is designed to minimize the handfeed required and so speed up production. Rapid motion from the extreme rear position to a point near the grinding position is secured by moving a conveniently located control lever. Actual grinding is by handfeed, but the control lever returns the wheel slide to the rear.

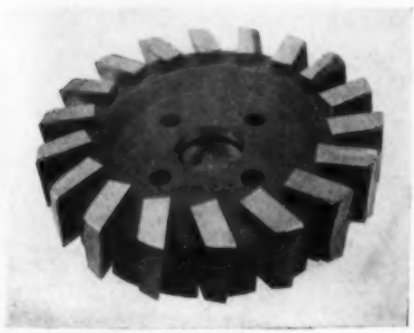


Norton Type A 10-Inch Cylindrical Grinding Machine

"O. K." Extra-Heavy Duty, Face-Milling Cutters

For milling large castings and forgings where considerable finish or variation in cuts are encountered, the O. K. Tool Company, Inc., Shelton, Conn., has placed on the market the extra-heavy-duty, face-milling cutter shown in the illustration.

These cutters are made in sizes from 8 to 30 in. in diameter. The blades used are all ¼ in. thick, but are made in two sizes, 1¼x2 in., and 2x2½ inches. The number of blades used varies with the diameter of the cutter.

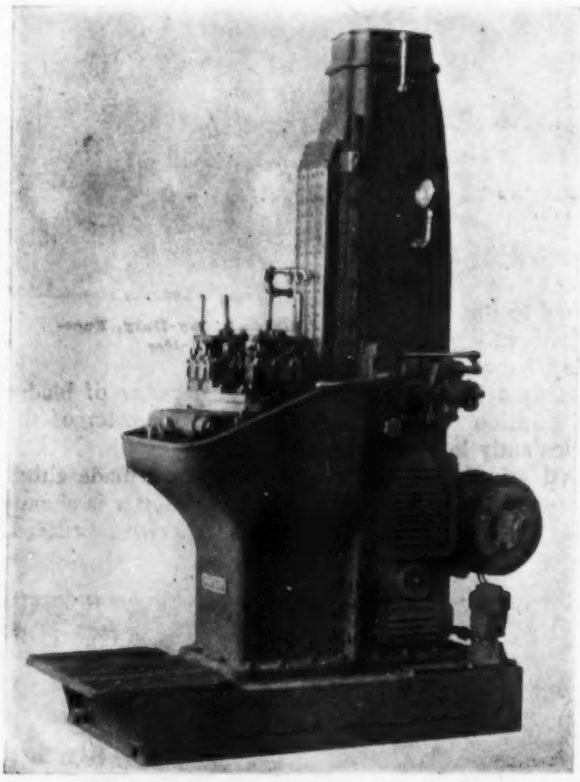


"O.K." Extra-Heavy-Duty, Face-Milling Cutter

While the cutters are made either left or right hand, the latter is always furnished unless otherwise ordered.

"Footburt" No. 1 Surface Broaching Machine

THE "Footburt" No. 1 surface broaching machine introduced by the Foote-Burt Company, Cleveland, Ohio, is used for roughing and finishing one or more flat or irregular surfaces in one operation. All work within certain size limitations is handled on a machine of standard dimensions, but the fixtures and broaches are designed specially for each job. Outstanding features claimed are high production, simplicity of construction, and low tool-maintenance expense.



"Footburt" No. 1 Surface Broaching Machine

The entire machining operation is accomplished at one pass of the broach. In most cases, four-station automatic-indexing work tables are used and production is set at the speed at which the operator can load and unload the work. Tiering of work where possible, and the use of simple, one-movement clamp levers enable the operator to handle a large number of pieces. The reciprocating movement of the broach is accomplished by a hydraulic pump driven by a motor through a silent-chain belt running in oil. Slow cutting speeds, averaging from 10 to 40 ft. per min. and solid support of the broach keep tool maintenance expense low.

The broach is of a heavy-back-type construction and is secured in a holder on the slide, making practically one solid piece and minimizing vibration. Because of the great number of teeth on the broach, the depth of the cut is distributed very evenly and no individual tooth is dulled by heavy cuts. The lower teeth are roughers and remove the major portion of the metal. The upper teeth do the final finishing. These factors mean long tool life and extreme accuracy. When it is necessary to sharpen the broach it is removed by withdrawing a few socket-head capscrews.

The broach holder is fastened securely to the broach slide, which is in turn bolted directly to the lower end of the hydraulic plunger, or piston rod. The slide moves up and down on long, narrow dovetail ways. The broach slide is supported throughout its entire length.

The pump, cylinder, and all piping are inclosed in the column, but are accessible through a door in the side. Piping is of heavy copper and the connections are of brass, making leakproof joints. The oil reservoir is open to the atmosphere at the highest point above the cylinder, thereby preventing the possibility of trapped air.

The frame consists of three major parts, base, column and table. These parts are heavy castings bolted solidly together to form a rigid foundation for the work. The base forms a tank of generous capacity in which the cutting oil is allowed to cool. It is designed with baffle plates to arrest any cuttings and prevent them from entering the pump compartment at the rear. Cuttings and chips are removed by swinging up operator's platform at the front of the machine.

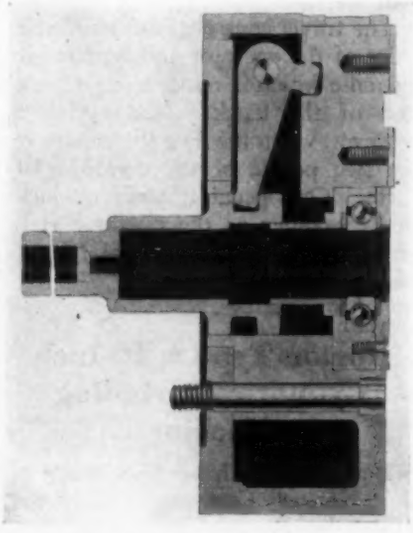
A 7½-hp. 1,800-r.p.m. constant-speed motor is usually recommended.

Lubrication of the machine is easy and positive. The pump, valve, and cylinder are filled with oil at all times. A few oil cups are used. A vacuum sight-feed oiler on the left side of the column oils the slide. Coolant is supplied to the work by a centrifugal, motor-driven pump submerged in the oil sump at the back of the base. The pump never requires priming. A ¼ hp. 1,725 r.p.m. constant-speed motor is part of the pump assembly.

Hannifin Air-Operated Lathe Chuck

The Hannifin Manufacturing Company, Chicago, Ill., has developed an improved air chuck equipped with ball bearing pilot bushings. This chuck is intended for boring operations and similar work where rigid or non-rotating pilot bushings, mounted in the center of the chuck, were formerly used.

The hole in the inner race of the ball bearing is ground to a very close fit to accommodate the pilot and the boring tool. When the pilot moves into the hole in the bearing, the inner race remains stationary with the pilot while the outer race of the bearing revolves together with the chuck.



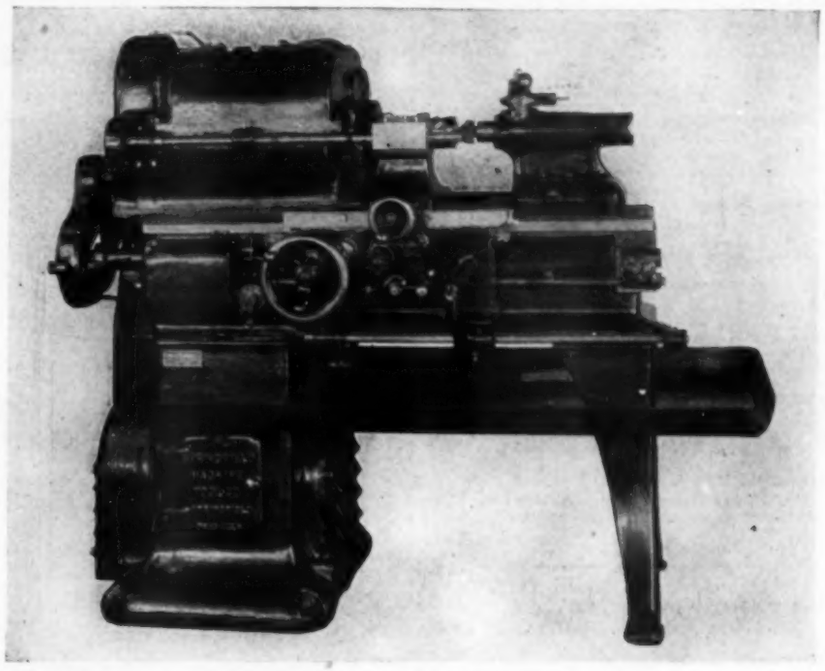
Hannifin Air-Operated Lathe Chuck with Ball-Bearing Pilot Bushings

Springfield 14- to 26-Inch, High-Speed, Geared-Head Engine Lathes

THE Springfield Machine Tool Company, Springfield, Ohio, has developed the design of its line of 14- to 26-in. geared-head engine lathes to adapt them for the tungsten carbide cutting tools now coming on the market. Timken bearings have been introduced to withstand the speed and the heat generated at the higher rate of operation.

Another important change made in the machine shown in the photograph is that it is driven from the motor to the main driveshaft with an endless belt, and from the drive shaft inside the headstock to the spindle with silent chain. It is, therefore, only a one-speed head, but arrangements for changing the speed have been made by means of different-sized pulleys which can be put on the motor pinion and the upper drive-pulley shafts. There are no gears running in the headstock. The motor is mounted in the heavy, cabinet-type leg. It is accessible through the large, hinged door at the front.

The machine in the illustration is operating with tungsten-carbide tools and working on aluminum pistons at the rate of approximately 1,100 cutting ft. per min. The piston to be turned was relieved on both sides of the wrist-pin bearing by means of the small relieving attachment shown on the machine. The pistons are finished in the lathe instead of on a grinder.



Springfield High-Speed, Geared-head Engine Lathe equipped to use tungsten-carbide tools. Aluminum pistons were turned at 1,100 ft. per minute and were finished on the lathe instead of on a grinder

Index of Machines at the Show

New Equipment on Exhibition, Arranged Alphabetically by Manufacturers

— A —

Page

Abrasive Machine Tool Co.
No. 5 surface grinder 530

American Tool Works Co.
Control mechanisms for "American" radial drills 488
Power rapid traverse for American "Auto-Oiled" shapers 508

Arter Grinding Machine Co.
Rotary surface grinder, 12-inch..... 492
No. 132 automatic cylindrical grinder 493

— B —

Baker Bros. Incorporated
No. 25 H.H. horizontal, hydraulic-feed, drilling and boring machine 517

Barnes Drill Co.
No. 262 sliding-head, self-oiling, all-geared drilling and tapping machine 508

Bath & Co., John
Adjustable plain plug gage..... 492

Blount Co., J. G.
Tap grinder 493

Bryant Chucking Grinder Co.
No. 24 deep-hole grinder..... 489
Improved No. 3 heavy-duty grinder.. 519

Buffalo Forge Co.
Sliding-head drill, 14-inch..... 495
Bending attachment for Buffalo bending machines 514

— C —

Canedy-Otto Manufacturing Co.
Multiple-spindle drills 509
Sliding-head sensitive drill, 21-inch.. 518
Sliding-head sensitive drill, 15-inch.. 524

Cincinnati Bickford Tool Co.
Column type "Super Service" radial drill, 11-inch 482

Cincinnati Shaper Co.
Gear burnisher 480
Heavy-duty shapers 525

Cleveland Twist Drill Co.
Tungsten-carbide-tipped twist drills and reamers 493

Cochrane-Bly Co.
No. 21 automatic high-speed saw.... 481

Colt's Patent Fire Arms Manufacturing Co.
"Autosan" two-tank metal parts cleaning machine 523

— E —

Eastern Machine Screw Corporation
"H & G" style D self-opening die-head 507
"H & G" threading machine..... 524
"H & G" chaser grinder..... 525

Elwell-Parker Electric Co.
Type EQ electric lift truck 530

— F —

Foote-Burt Co.
No. 1 surface broaching machine.... 532
No. 16 hydraulic- and mechanical-feed drilling machines..... 496

— G —

Gairing Tool Co.
Swing-tool boring head..... 497

Gardner Machine Co.
No. 9, 40-inch "Super Disc" grinder.. 501
No. 84 special hexagon nut grinder.. 516

Geometric Tool Co.
Style KJ, solid, adjustable diehead.. 505
Classes SJ and R adjustable taps.. 509
Universal chaser grinding fixture.... 517

Gleason Works
Spiral-gear-cutter, angle-testing device 477
Spiral-bevel gear generator, 3-inch.. 505

Goddard & Goddard Co.
Inserted-blade cutters 481

Goss & DeLeeuw Machine Co.
No. 6 work-rotating chucking machine 474

Gould & Eberhardt
No. 9-H universal and Nos. 48-HS and 48-HL gear hobbing machines 503
Manufacturing-type shaper, 36 inch.. 527

Greenfield Tap & Die Corporation
No. 12 high-speed internal grinder.. 529

— H —

Hall Planetary Co.
"Machinabilimeter" 528

Hammond Manufacturing Co.
Six-spindle, deep-hole, oil-feed drilling machine 504

Hannifin Manufacturing Co.
Models WV-320 and WH-250 wedge-type, air-operated rivet presses.... 487
Hydro-pneumatic broaching press for short holes 521
Air-operated lathe chuck..... 532

Henry & Wright Manufacturing Co.
"Hi-Power," sensitive drilling machine, ¾ inch 490

Hill-Curtis Co.
Type F-B electrically-driven, railroad-journal, wedge reclaimer.... 519

Hoefer Manufacturing Co.
High-production drilling machine, 5-7½ hp. 510

— I —

International Machine Tool Co.
"Libby International" heavy-duty, cross-sliding turret lathe..... 521

— K —

Kearney & Trecker Corporation
Bridge-type vertical "Mil-Waukee-Mil" 498

Keystone Lubricating Co.
"Pneuma-Lectric" lubricating system 522

— L —

Landis Machine Co.
Automatic bolt-forming and threading machine 524

Landis Tool Co.
Type C plain hydraulic grinder, 6 inch 512
Semi-automatic hydraulic ball race grinder, 5-inch 515

Lees-Bradner Co.
Oil-well-tool threading and turning machine 494
Heavy-duty thread miller..... 526

Lodge & Shipley Machine Tool Co.
Selective-head engine lathe, 14-inch 491

Lucas Machine Tool Co.
Model 41 horizontal boring machine and square swivel tables..... 478

Ludlum Steel Co.
Strauss tungsten-carbide cutting metal 492

— M —

Manning, Maxwell & Moore, Incorporated
Putnam rotary, continuous milling machine, 72-inch 477
Putnam type K, rotary, gang slitting machine 513

Moline Tool Co.
No. 14 "Hole Hog" cylinder borer.. 510

Monarch Machine Tool Co.
Hydraulic automatic lathe..... 522

— N —

National Automatic Tool Co.
"Natco" D 13H and C-5 multiple-spindle drilling machines..... 526

New Departure Manufacturing Co.
Double-row ball bearings and applications 498

Noble & Westbrook Manufacturing Co.
No. 41 graduating machine..... 518
Nos. 4 and 15 general-purpose marking machines 528

Norton Co.
Model 84, 17x30- to 36-in., double-head, hydraulic crankpin grinding machine 502
Type BA 10x50-in. cylindrical grinding machine with hydraulic table traverse 516
Type 50 crankshaft lapping machine 518
Type A 10-in. cylindrical grinder... 531

— O —

Ohio Machine Tool Co.
"Super-Dreadnaught" shaper, 36-in.. 523

O.K. Tool Co., Incorporated
Offset, side-lock toolholder..... 512
Extra-heavy-duty, face-milling cutter 531

Oliver Instrument Co.
No. 2 "Arc" face-mill grinder..... 479
Heavy-duty die-making machine.... 484
Tap grinder 484
No. 21 drill grinder..... 486

— P —

Porter-Cable Machine Co.
Type K-8, "Speedmatic," portable electric saw 482
"Carbo-Lathe," 12x18-inch 483

Pratt & Whitney Co.
Nos. 3 and 3A jig-boring machines.. 497
Six-spindle, vertical, deep-hole driller 500

Putnam Machine Works
Rotary, continuous milling machine, 72-inch 477
Type K, rotary, gang slitting machine 513

— R —

Reed-Prentice Corporation
No. 5 jig-boring and vertical milling machine 485

Rotor Air Tool Co.
Types E-4-C and E-40-C production drills 496
Type D-0 standard and high-production grinders 505
Type E-0 high production drill..... 515

Ryerson & Son, Inc., Joseph T.
Flue-cutting and polishing machine.. 480
Work-rotating attachment for No. 0, high-speed friction saw..... 489
No. 7 combination shear, punch, and coper 517
Flue roller 521

— S —

Sellers & Co., Inc., William
No. 1 hob and cutter grinder..... 495

Seneca Falls Machine Co.
Automatic feeding devices for model U "Lo-Swing" automatic lathe.... 511

Sidney Machine Tool Co.
"Tritrol" engine lathes, 14- to 24-inch 506

Springfield Machine Tool Co.
High-speed, geared-head, engine lathe, 14- to 26-inch 533

Stuart & Co., D. A.
"Drawsol" deep-drawing compound.. 491

— T —

Tuthill Pump Co.
Model H high-pressure oil pumps.... 480

Twin Disc Clutch Co.
Type C.C. multiple-disk machine-tool clutch 487

— U —

Union Manufacturing Co.
Electric-power-operated chuck, 10- to 22-inch 490

Universal Boring Machine Co.
No. 40 tri-way horizontal boring machine 507

U. S. Electrical Tool Co.
Multi-speed buffer and polisher..... 491

— V —

Van Norman Machine Tool Co.
No. 25 oscillating grinding machine 512

— W —

Walker Co., Inc., O. S.
Model D, single-stroke, surface-grinding machine 514

Warner & Swasey Co.
No. 5-A universal turret lathe..... 476

NEWS
OF THE WEEK

Record Attendance at Metal Congress
Four Societies Hold Meetings

Many prominent European manufacturers visit Show
R. G. Guthrie to head A.S.S.T. for 1930

WITH an attendance of 9,000 on the opening day, the National Metal Exposition established a new record at Cleveland last week. Four national engineering societies held meetings in connection with the exposition and congress, the A.S.S.T. having headquarters at the Hotel Cleveland, the A.W.S. having headquarters at Hotel Statler, the Institute of Metals Division and the Iron and Steel Division of the A.I.M.E. and the Iron and Steel Division of the A.S.M.E. having headquarters at Hotel Cleveland and Public Auditorium respectively. The divisions of the two societies also held joint technical sessions with the other societies.

Many foreign engineers enroute to the World Engineering Congress at Tokyo in October, stopped off to attend the various technical sessions and to see the exposition. Thomas A. Edison was also expected to attend and was made an honorary member of the A.S.S.T. at the annual banquet on Thursday night, Sept. 12, although he was too ill to attend.

Nominations of officers for the A.S.S.T. were held at a business session during the convention of the society. R. G. Guthrie, chief metallurgist of the Peoples Gas, Light & Coke Co., and vice-president of the A.S.S.T. during 1929, was nominated for president during the coming year. John M. Watson, metallurgical engineer of the Hupp Motor Car Corporation, Detroit, was nominated for vice-president and A. O. Fulton, president of Wheelock Lovejoy and Company, Inc., was nominated for treasurer. The nominees for directors were: W. B. Coleman, president of the W. B. Coleman Co., Philadelphia, and O. E. Harder, professor of metallography, University of Minnesota, Minneapolis. Nomination to these offices virtually assures election, since only one nomination is made for each position.

Chief among the innovations in the show were the great number of new alloys. Alloys for cutting, heat-treating, stain, acid, wear and corrosion resisting, and a number of other special uses were introduced by the more than 300 exhibitors. Also notable was the variety of rods shown in the welding section, together with many new types of welding apparatus. Several newly imported foreign machines were also on exhibition, as well as a number of domestic furnaces and machines.

Dr. Albert Sauveur, Harvard University, in his lecture, "Steel at Elevated Temperatures," delivered as the Campbell Memorial Lecture for 1929, on Wednesday morning, Sept. 11, explained a new method for testing steel developed at Harvard University. According to Dr. Sauveur, the World War began the stimulation of scientific research by industrial concerns. Stainless steel and Duralumin were the first alloys discovered in the Age of Alloys which is now beginning.

R. G. Guthrie

Chicago will be host to the 1930 exposition and show. According to an announcement by W. H. Eisenmann, in charge of the show, the dates will be Sept. 22 to 26, with headquarters at the Stevens Hotel which affords 76,000 sq.ft. of floor space. It is probable that all the organizations taking part in the 1929 congress will take part in the 1930 congress.

* * *

Commercial Heat-Treaters Organize Nationally

A group of outstanding commercial heat-treating plant managers in attendance at the National Metal Congress held a meeting at the Hotel Cleveland, Cleveland, Ohio, on Sept. 10, to consider plans for improving conditions in the commercial heat-treating field. The group will lay out a program of organization at once, and aims to call together a representative group of heat treaters for the forming of an association at the next meeting of the A.S.S.T. The objectives of the organization will be to bring about improvement of conditions, processes, and methods in the field, to conduct co-operative research, and to eliminate unethical methods.

Among the representatives present at the conference were: S. P. Rockwell, The Stanley P. Rockwell Co., Hartford, Conn.; Ellis Snow, The Ellis Snow Co., Chicago, Ill., I. Linbeig, Linbeig Steel Treating Co., Chicago; Theo. Barker, Accurate Steel Treating Co., Chicago; O. T. Muhlmeyer, Rockford, Ill.; A. D. Bach, New England Metallurgical Co., Boston, Mass.; N. M. Salkover, Queen City Steel Treating Co., Cincinnati, Ohio; and C. W. Derhammer, Lakeside Steel Improvement Co., Cleveland.

It was arranged that commercial heat treating companies in the East desiring to join the organization may get further information from S. P. Rockwell of the Stanley P. Rockwell Co., Hartford, Conn. Those in the West may get in touch with N. M. Salkover, Queen City Steel Treating Co., Cincinnati, Ohio.

* * *

Engineers Entertain Drs. Koettgen and Matschoss

A dinner in honor of Dr. Carl Koettgen, president of the German Engineering Society, Berlin, and managing director of the Siemens-Schuckert Works, and several of his fellow delegates from Germany enroute to the World Engineering Congress in Tokyo next month, was given by the American Committee of the World Engineering Congress on Thursday, Sept. 12, at the Engineers' Club, New York City. Dr. Koettgen's associates who were honored at the dinner were Prof. Conrad Matschoss, director of the German Engineering Society, and Dr. Emil Probst of Karlsruhe.

* * *

Railway Tool Foremen Meet

Railway tool foremen of the country met in Chicago from Sept. 11 to 13, an exhibition of equipment also being made at that time. Executives of the various railways addressed the sessions. A. A. Ferguson, Missouri-Pacific Railroad, was elected president for the coming year. A more extended report will be given in the next issue of *American Machinist*.

BUSINESS BAROMETER

"United States of Europe" suggested by Briand is a possible powerful economic factor with 27 nations in agreement

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

IF THE history of last week were written with due regard to the economic importance of the events recorded, first place would be given to Premier Briand's suggestion that a United States of Europe should be organized. In this suggestion twenty-seven nations, including Germany, have acquiesced. While the vision that is conjured up will not be realized for many years, the serious consideration of it at Geneva is decidedly encouraging. It is perhaps proper to explain that Briand's proposal does not contemplate a political union, but simply a federation held together by economic bonds. Such a union would not have been considered ten years ago, and the present willingness to discuss it is an omen of great and favorable portent to humanity.

Next in importance to the proposed United States of Europe is President Hoover's action in demanding a complete investigation of what has been called the "profiteering patriotism" that has inspired some of the opponents of naval disarmament. As the President's attitude is likely to have a profound bearing upon the conference now in progress in Geneva, and those that are to follow it, it may also be counted upon as an influence that will tend to lessen the likelihood of war in the future.

The probability of a warless world would be a bullish factor whose effect it would be impossible to discount or visualize. But more or less skepticism still exists with regard to the possibility of universal peace, and the speculators have failed to heed the events by which the idealists have been so much impressed and encouraged. Hence, more prosaic influences have been in the ascendant, and the New York stock market has shown a reactionary tendency that has been punctuated by occasional recoveries which have lacked spontaneity and enthusiasm. This is natural and is to be expected as long as call money rules at from 7 to 10 per cent.

These rates have been gradually drawing capital to the New York Stock Exchange and the Curb Market, as well as to the other stock markets of the country where even higher interest is being paid. Brokers' loans in New York increased another $120,000,000 last week, the fourth week in succession by which they have risen more than a hundred million dollars. But all loans are carefully scrutinized, and bankers are manifestly reluctant to increase their advances upon stocks and bonds. Hence the money that the market gets is being drawn from investment trusts and other corporations which have large unemployed balances. The situation is, however, losing its terrors as it is coming to be realized that it would be impossible to promptly repay all of the call loans now outstanding, and it begins to look as if America is developing a money market that will be independent of the banks. The situation is a novel one, and it remains to be seen how it will work itself out. Meantime, all that can be said of the stock market is that it seems to have lost a good deal of its speculative enthusiasm despite the recurrent episodes of strength. But it has become so big that its various departments no longer move with anything like unity.

Industrial stocks were adversely affected last week by the large reduction in unfilled orders reported by the United States Steel Corporation, and rumors that some manufacturing and commercial corporations are commencing to be conscious of a slight recession of trade. But this is hard to confirm, and real evidence that trade is slackening is still lacking. August awards of building contracts were 5 per cent less than last year, but the automobile factories are holding their schedules up to the July and August rate, car loadings are breaking all records for this time of year, and the statistical position of the textile industries is so improved that they seem assured of a satisfactory fall.

Most of the crop estimates issued by the government last week forecast smaller crops than were indicated a month ago. Wheat was an exception, as it showed a slight increase in the indicated yield, but its price has risen upon reports of crop damage in the Argentine. Corn and cotton estimates were both reduced, although neither advanced much in price.

On the other hand, sugar has been remarkably firm, reflecting the tenacity with which the Cuban "single selling agency" is holding to the balance of the supply, as well as drouth in Europe.

Aside from the highly auspicious developments at Geneva, the only news from Europe that calls for comment is the situation in Manchuria, which seems to be in a condition of political as well as military anarchy. The Soviet Government at Moscow continues to disavow any intention to make war upon the Chinese, and the Chinese in turn have declared themselves in favor of peace, but fragments of the Chinese and Russian armies appear to be fighting each other in Manchuria, where no one seems disposed to assume the rôle of peacemaker. It is impossible to say what the outcome will be, but its effect upon American business is not expected to be important.

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

PROSPECTIVE purchasers in the machine-tool industry seem to be marking time, inquiring, but awaiting what may be new at the National Machine Tool Builders' Show before they decide definitely to place orders. What buying is occurring is a result of necessity to maintain production schedules or to replace obsolete equipment at once. Deliveries also fell off slightly during the week as a result of the sudden realization of manufacturers that the Show is but two weeks away, and their new products must be ready on time if they are to win any of the business of the new buyer—who must be convinced that equipment is up-to-date before he buys.

NEW YORK reports business "just rolling along," with the General Electric and Western Electric leading the buying. Canadian manufacturers are active as a result of railroad purchases, and business is 30 per cent better than it was a year ago. The Southern District reports improvement in inquiries, but sales rather slow. Detroit and Chicago report several big orders during the past 10 days, with the automobile and accessory manufacturers helping. The rumored change from six to eight cylinder cars is said to be contributing to the business activity. Cincinnati and Indianapolis report the airplane industry "looking up," and a good demand for all tools, discounting the Show. New England companies are sending out increasing numbers of inquiries, and railroads are showing an intention of buying.

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THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

THE following reports, gathered from the various machinery and machine-tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

An air of expectancy has settled over the New York district, with all prospective purchasers of machinery who can possibly do so attempting to hold off on purchases until they have had an opportunity to look over "what's new at the Show." Buying is mainly for replacement and for use where production schedules demand machinery immediately. The wide range of machinery and machine tools which it is expected will be exhibited for the first time at the National Machine Tool Exposition undoubtedly includes many which may be utilized instead of the machines now operating in many shops, and it is these machines that buyers are awaiting.

The General Electric and Western Electric are buying from inquiry lists sent out two weeks ago. Other companies have shown little interest, buying only such machinery and equipment as may be necessary to maintain production schedules, or to replace obsolete equipment. The used tool and machinery market is poor, largely because of the continued scarcity of good machinery which also results indirectly from the coming show. Manufacturers are retaining in operation as long as possible machinery which they will replace eventually in order to continue production. Business is characterized as "rolling along" with improvement expected, and the possibility of an unusually good fall, if present indications lead to future certainties.

Deliveries, which have been bad, are worse because of the sudden realization of manufacturers that the Show is but two weeks away, and the new tools they will exhibit must be completed at once at all costs. Prices have not changed, and inquiries show the prevailing lack of interest.

SOUTHERN DISTRICT

Though inquiry is beginning to show signs of improvement in the southeastern district, machinery and machine-tool sales are reported by dealers and jobbers to be rather slow, yet about on a par with the normal volume of business ordinarily experienced at this period. Inquiries are in sufficient volume to give an optimistic tone to the outlook for business during the fall period, and most of the dealers express the opinion that fall business will be better than normal this year in the Southeast.

Somewhat better demand is reported by distributors of woodworking machinery to the furniture manufacturers in the Southeast, but in other branches of the woodworking and lumber fields, sales continue rather slow. There has also been improvement noted recently in sales of equipment to contractors in larger centers, as building is unusually active at this time in the large southeastern cities. In the garage and machine shop field, business continues slow, with few if any orders reported for other than used or rebuilt equipment. Road machinery is also quiet, but dealers believe the 1930 season in the Southeast will be one of the largest they have ever experienced.

CINCINNATI

Several of the machine-tool manufacturers of the Cincinnati district express the opinion that ultimately the airplane industry will become an important field. In the past week, airplane manufacturers have made purchases of regular tools in this market, and, it is thought they will require the development of specialized tools soon to meet the requirements of mass production and standardization.

Manufacturers report that in the past week there was a good demand for all varieties and sizes of tools. While there were no large purchases, business was sustained at a good level by orders for from one to three pieces of equipment. Orders booked came from all parts of the country, the needs of no industry nor no section being an outstanding feature. In only one case was it reported that there had been a falling off of orders, this being a slight recession that was attributed to the fact that purchases were put off until after the coming machinery exhibit in Cleveland.

Inquiries flowed in freely during the week, manufacturers state, and among these were many which indicate that in the near future orders may be larger. The great majority of the inquiries were for single tools and replacements, however, and these were well scattered over the country and well diversified. The market trend in local and adjacent territory is upward, and the outlook is regarded as most encouraging, regardless of the fact that there may be a lull in advance of the machinery exhibit of the National Association.

INDIANAPOLIS

Some improvement has been noticed during the last two weeks in the machinery and machine-tool trade. The improvement seems to come mostly from the automobile business, which is considerably better than it was during the mid-summer months. Perhaps the brightest spot in the entire scheme of business is the airplane demand, which for small tools has developed into one of the most promising markets the area has had for years.

Railroad demand is picking up. During the last week three of the big trunk lines have re-established shops that formerly were idle. They are curtailing purchases wherever possible, but the season demands some expenditures that are unavoidable. Demand for tools from the radio field is rather exceptional. This particular line of business has been one of the most prosperous of any during the last summer.

NEW ENGLAND

The early September machine-tool situation has been augmented by the introduction of a substantial amount of new inquiry into this territory. At least one railroad interest is circulating a new list for machine tools in New England. Buyers have given up hope for better deliveries and are placing orders, believing they will benefit in the long run. In this respect, one outstanding Connecticut machine tool builder, operating at capacity, is requiring from one to three months delivery on machine tools which normally have been carried in stock.

The New York, New Haven & Hartford, and the Boston & Maine railroads are planning heavy expenditures for rolling stock and miscellaneous improvements. Special attention will be given to make improvements to expedite freight movement, in which modern handling and conveying equipment for all purposes will play an important part. The New Haven road alone plans to lay 20,000 additional tons of 130-lb. rail. Total expenditures on these programs reaches several million dollars.

The current week showed an improved business tone over the previous week and indicates the beginning of a brisk fall trend. Orders for single units predominated the week's bookings. Buying on the part of the electrical manufacturing industry continued strong and new requirements from this source were listed totalling 40 or 50 tools. Aeronautical contracts broaden with indications of new business from Waterbury, Springfield, Lowell, and Pawtucket. Dealers in used machinery anticipate a turn for the better during the fall months.

CHICAGO

Little change from a week ago is noted in the machine-tool market. Buying continues on a good level, comparing favorably with the average of August. Present business comes from scattered sources throughout the middle west, the Chicago area contributing in good measure to the total of bookings. New railroad inquiries, notably that of the Santa Fe, indicate that western roads are contemplating material additions to their shop equipment. Machinist's tools and small electrically operated units are having a steady sale, the auto-parts and automotive accessory industries being reported as among leading buyers in these lines. The International Harvester Co. still is an important factor in the market, additional inquiries being received for a number of tools. Grinding machines and abrasives are selling more actively than during last month. In no line of tool production is there reported any recession since September opened, such slight falling off as was noted in a few cases late in August having been offset by an increased volume of sales in the last ten days. Demand for used tools is showing some improvement. As noted a week ago, many selling agents and district managers are hoping to close a number of prospective sales during, or shortly following, the Cleveland Machine Tool Show.

CANADA

Reports from several of the leading machine-tool manufacturers in Canada indicate that business is good and is probably better than at any time in the past two or three years. A large amount of this business is attributed directly to the railways, but in addition these manufacturers report sustained business from structural steel plants, mining and hydraulic machine makers, and pulp and paper concerns.

Operations of iron and steel plants are being maintained at a high level for this period. The British Empire Steel Corporation's rail mills and other departments of the plant are still working at capacity. Plants of Western Steel Products are all working at or close to capacity, with a good volume of business in hand or in sight. The plants of the Canada Wire and Cable Co. have a steady four months work ahead of them.

Farm machinery sales in Western Canada this year are decidedly limited. This is understood to be due to the short grain crop. On the other hand, there is a good demand for agricultural machinery in the east, where crop conditions are distinctly

favorable. Government statistics show further improvement in the employment situation in August. Construction and manufacturing reported the largest gains. While automobile production in August showed a seasonal decline, production for the first eight months of the year showed an increase of more than 30 per cent over the corresponding period of 1928.

DETROIT

The receipt of a number of large orders for machinery and machine tools here within the past ten days indicates that the many favorable predictions for September and the balance of the year are likely to be fulfilled. Automobile and accessory manufacturers are not only placing important orders for a variety of equipment but they are making inquiries that give promise of increased business within the next two or three months. Thus far the orders do not constitute a volume sufficient to make September one of the high months of the year, but they break the depression of July and August and make a good beginning for the anticipated fall prosperity.

Dealers are receiving many inquiries from automotive manufacturers, and it is expected that a large number of these will be productive of good-sized orders in the near future. It has been freely stated that many of the large automobile builders are changing from six-cylinder to eight-cylinder motors and the equipment for the production of the new motors is now being purchased.

Additional machinery, tools, dies, and fixtures for this work and for the many other changes now being contemplated, will probably be bought here within the next few weeks. Some of the dealers believe that prospective buyers are holding off until after the annual show in Cleveland in October and that there will be a flood of orders during and immediately after the show. At present the orders are mainly for replacement and production equipment although there is a fairly large volume of new work. Business conditions as a whole are fair, with some improvement noted within the past two weeks.

Business Items

The Herman Nelson Corporation, Moline, Ill., has purchased two tracts on River drive at Twenty-fifth Street from the Velie Motors corporation, comprising a total acreage of five acres. One section contains a concrete building, 80x400 ft. The site will be utilized, for the present, as a warehouse property but later manufacturing operations may begin there.

The Warner Gear Co., a division of the Borg-Warner Corporation, has completed a $1,250,000 addition to its plant at Muncie, Ind. This addition will increase the capacity of the Warner plant by approximately 30 per cent. The plant is of steel and pressed brick construction.

The Black & Decker Manufacturing Co., Towson Heights, Md., has purchased a building containing 140,000 sq.ft. of space at Kent, Ohio, and will use it as an expansion for the company's Cleveland plant, known as the Domestic Electric Company.

The Diamond Chain & Manufacturing Co., Indianapolis, Ind., is completing a plant extension and the erection of a new office building. The four-story office and administration building is of modern concrete fireproof design and construction and houses the engineering and drafting departments on the third floor, while the lower two floors are used for a factory extension. The new buildings will add about 40,000 sq.ft. of floor space to the plant of the company.

The Hartford Bearings Co., Hartford, Conn., organized recently by Charles H. Abbott, Sidney E. Stockwell and Charles Koehler has engaged manufacturing space on the second floor and offices on the first floor of the building at 603 Franklin Av., Hartford.

The Chain Belt Co., Milwaukee, has moved its Houston, Tex., office to larger quarters at 1310 Second National Bank Building. They were formerly located at 1000 Marine Bank Building. Russell G. Davis is manager.

The Bucyrus-Erie Co. is co-operating with Ruston & Hornsby, Ltd., Lincoln, England, in the formation of a new company in England for the manufacture of excavating machinery. The entire stock of the new concern will be held by the two companies forming it.

The H. Severin Manufacturing Co., makers of special tools and dies, 4607 Ravenswood Ave., Chicago, has bought the one-story factory of the Holmes Electric Co., 5116 Ravenswood Ave., containing 7500 sq.ft. of floor space.

The Berliner-Joyce Aircraft Corporation, Baltimore, Md., will build a 120 x 50 ft. addition to its plant adjoining the Municipal Airport for use as an aerodynamical laboratory.

The Hill Clutch Machine & Foundry Co., Cleveland, has recently opened a New York office at 30 Church St., Room 1525, New York City, which will be in charge of Arthur L. Whiteside.

The Pope Machine Co., Haverhill, Mass., manufacturer of wood heel and special machinery, has changed its name to the Pope Machinery Corporation.

The Canadian Atlas Steel Co., Ltd., Toronto, Ontario, has taken over the exclusive agency for the sale of Hy-Ten alloy steels in Canada.

The National Bronze & Aluminum Foundry Co., Cleveland, is completing a specially designed furnace and erecting an addition to its factory.

The Thorne-Hawk Body Co., Cleveland, recently rented a three-story brick building for additional manufacturing space.

The U. S. Axle Co., Inc., Pottstown, Pa., has moved its Chicago warehouse stock to 21st and Wabash Ave., Chicago.

The Universal Lubricating Co., Cleveland, is building a $25,000 addition to its plant.

The Cisco Machine Tool Co., Cincinnati, Ohio, has changed its name to the General Radial Drill Company.

The Pipe Machinery Co., 930 East 70th St., Cleveland, has awarded a contract for a one-story addition.

Personals

HENRY GARDNER has been appointed vice-president in charge of sales by the Coppus Equipment Co., Worcester, Mass. Mr. Gardner is a veteran railroad man, first entering the service of the Boston & Maine shops at Boston after graduating from the Massachusetts Institute of Technology in 1896. Later he was locomotive designer for the H. K. Porter Co., Pittsburgh, and chief draftsman for the Pittsburgh & Lake Erie Railroad. He was supervisor of shop systems for the New York Central from 1908 to 1914, and later was with the Baltimore & Ohio shops as special mechanical engineer.

A. W. NORRIS, formerly a salesman with the Genuine Parts Co., Atlanta, has purchased the bankrupt stock of the Macon Bearings & Parts Co., Macon, Ga., and has organized the Motor Parts Corporation as distributors of standard automotive parts and garage machinery and tools in the middle Georgia territory. Headquarters have been established by the new company in Macon at 621 Third St.

E. J. FILIATRAULT, formerly purchasing agent for the Chandler-Cleveland Motors Corporation, Cleveland, now a part of the Hupp Motor Car Corporation, has become affiliated with the sales department of the Murray-Ohio Manufacturing Co., Cleveland.

ERNST HEYDE, formerly foundry superintendent for Scalla & Co., Buenos Aires, Argentina, S. A., has returned to the United States. He formerly was connected with the Wolff Manufacturing Co., Chicago, and the Standard Sanitary Co., Richmond, California.

J. O. MAIZE, for 15 years associated with the Keystone Steel & Wire Co., Peoria, Ill., has been transferred from Waterloo, Iowa, to Des Moines, in charge of sales in Polk and 30 adjacent counties for the Keystone.

A. J. HENSELER, for three years special representative for *Automotive Daily News* in the western states, has been appointed sales and advertising manager for the Whitney Metal Tool Co., Rockford, Illinois.

E. A. MCBRIDE, formerly general superintendent of the Thompson Products Co., Cleveland, has been appointed factory manager. J. M. KERWIN will succeed Mr. McBride as general superintendent.

JAMES A. TALBOT, one of the founders and incorporators of the Western Pipe and Steel Co. of California in 1907, has been made president, succeeding J. W. Mason, who has retired after a long service with the company.

A. J. WARDLE, president of the McKay Machine Co., Youngstown, Ohio, machinists and engineers, has been elected treasurer and manager. He succeeds THOMAS L. THOMAS, who is affiliated with the Youngstown Foundry &

Machine Co., that city. E. R. TYRRELL, formerly plant engineer in the sheet department, Youngstown, Ohio, works, Sharon Steel Hoop Co., has been appointed chief engineer of the McKay Machine Co.

W. C. CARTER, formerly vice-president in general charge of production at all Link-Belt plants, will assume the duties of vice-president and general manager of the Chicago plant at once, to take the place of F. B. Caldwell, who resigned recently because of ill health. E. J. BURNELL, who was manager of the Pittsburg office, has been appointed sales manager of the Western Division with

W. C. Carter

headquarters at the Chicago plant. NELS DAVIS, from the Chicago engineering sales force, succeeds Mr. Burnell as manager of Link-Belt's Pittsburgh office.

MELVIN E. FUNK, formerly assistant general manager of the Philadelphia Electric Co., Philadelphia, has been elected vice-president in charge of engineering. He has been with the company for the past 25 years.

ERNEST LANCASHIRE has resigned his position on the faculty of the University of Illinois to accept a position with the American Steel Foundries at the Granite City, Ill., plant.

FRED FOOTE, formerly superintendent of the Milwaukee Gray Iron Foundry Co., Milwaukee, now is associated with the Prime Manufacturing Co., Milwaukee, as foundry superintendent.

F. B. LOHNES, formerly connected with the General Electric Co., at the Lynn, Mass., plant, now is associated with the Old Colony Foundry Co., East Bridgewater, Mass.

CHARLES PIEZ, president of Link-Belt Co., Chicago, has been elected a director of the Illinois Bell Telephone Co., succeeding the late Chauncey Keep.

JAMES WORK, governmental aviation expert, has been appointed vice-president of the Detroit Aircraft Corporation, Detroit.

W. S. RUGG, vice-president of the Westinghouse Electric & Manufacturing Co. has been appointed on the committee for the award during the next five years of the Edison Medal given by the A.I.E.E. Mr. L. W. Morrow, editor of *Electrical World*, and R. F. Schuchardt of the Commonwealth Edison Co. were also appointed. Samuel Insull of Chicago is chairman of the committee.

W. G. TYLER, Denver, has developed a new rotary turbine gas engine.

Obituaries

NATHANIEL MONTGOMERY RICE, a vice-president of the New York, New Haven, & Hartford Railroad since 1925, died on Sept. 4 at New Haven, Conn. He had been on leave of absence since June because of ill health. Born in Rome City, Ind., 61 years ago, Mr. Rice left home at 14 to work on a farm, and four years later was a brakeman on the Gulf, Colorado & Santa Fe Railroad. In 1890, he became storekeeer at Temple, Tex. Ten years later, after the Galveston flood, Mr. Rice rendered such services in reconstruction that he was made special representative of the vice-president in charge of operations of the Santa Fe Railroad with headquarters in Chicago. In November, 1913, he went to St. Louis as a chief purchasing agent of the Frisco Railroad, and in 1915 became vice-president of that road. Three years later he became vice-president of the Pierce Oil Co., St. Louis. He returned to railroading in 1920 as general purchasing agent of the New Haven Railroad. He spent a total of 43 years in railroad work.

WALTER E. FISH, 65 years of age, formerly manager of the Lynn, Mass., works of the General Electric Co., and under whose direction the present River Works were built, died Sept. 8 after a two months' illness. He was born at Taunton, Mass., and obtained his higher education at Harvard University and the Massachusetts Institute of Technology. He became identified after graduation with the Thomas-Houston plant at Lynn, now the General Electric Company, spending several months in the research laboratory of Prof. Elihu Thomson. In 1890, returning to this country from Europe, he became prominent in the management of the Bernstein Electric Co., South Boston. After a short period he went to Lynn as assistant to E. Wilbur Wright, Jr., and, in 1894, became manager. He established the present River Works on the Saugus River. He resigned in 1920 to become manufacturing engineer with the International Electric Co., Paris, France, but returned in 1922 and was made consulting engineer of the General Electric Co. He retired in 1924.

JOHN DAVID HURLEY, president and founder of the Independent Pneumatic Tool Co., Chicago, died recently at his home in the Edgewater Beach Hotel in that city. His early employment was with the Chicago, Burlington & Quincy Railroad, and then with the Louisville & Nashville Railroad at Louisville, Ky. Later he took an active part in building railroads in Old Mexico where he spent several years of his early business career. About 1898, he, with his brother, Edward N. Hurley, Sr., organized the Standard Pneumatic Tool Co. On March 1, 1902, this company was absorbed by the Schwab interests and Mr. Hurley became identified with the Rand Drill Co., New York. In 1905, Mr. Hurley returned to Chicago and organized the Independent Pneumatic Tool Company.

RICHARD STOCKTON EMMET, superintendent of the scrap department of the General Electric Company, Schenectady, N. Y., died Aug. 30. He was 60 years of age. Before joining the General Electric Co. in 1904, Mr. Emmet was paymaster of the Chicago, Burlington & Quincy Railroad.

GEORGE THOMAS SMALLWOOD, 75 years of age, retired inventor and mechanical expert, died at his home in Washington, D. C. on Sept. 9 after a long illness. He had retired from active work a number of years ago.

PAUL MARCHETTI, president of the Marchetti Motor Co., Burlington, Calif., was killed Aug. 31, when his airplane fell into the ocean near Mills Field.

Forthcoming Meetings

MACHINE TOOL BUILDERS EXPOSITION. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 1415 Enquirer Bldg., 617 Vine St., Cincinnati.

NATIONAL SAFETY COUNCIL. Eighteenth annual meeting, to be held in Stevens and Congress Hotels, Chicago, Sept. 30 to Oct. 4. William H. Cameron, 108 East Ohio Street, Chicago, is managing director.

SOCIETY OF AUTOMOTIVE ENGINEERS. Production meeting at Hotel Cleveland, Cleveland, Ohio, Oct. 2 to 4. Coker F. Clarkson, 29 West 39th St., New York, is secretary.

GRAY IRON INSTITUTE—Annual meeting, Hotel Cleveland, Cleveland, Ohio, Wednesday, Oct. 16. Information may be obtained from Arthur J. Tuscany, manager, Terminal Tower Building, Cleveland.

SOCIETY OF INDUSTRIAL ENGINEERS. Sixteenth national convention at Hotel Statler, Cleveland, October 23 to 25. Requests for programs should be sent to S.I.E. national office, 205 West Wacker Drive, Chicago.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Semi-annual fall meeting at the Benjamin Franklin Hotel, Philadelphia, October 24 to 26. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

THE WEEKLY PRICE GUIDE . . . S

Rise and Fall of the Market

THE railroads are coming into the steel market. Otherwise there is some uncertainty, due to smaller demand in prospect for the remainder of the year. Nevertheless, the mills are operating at slightly over 90 per cent capacity. Linseed oil prices are advancing. On Sept. 11 the National Lead Co. announced a price of 16c. for lots of less than 5 bbl.; on Sept. 12, this price was withdrawn. The actual quotation is said to be nearer 17.2c.

(All Prices as of Sept. 13, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$17.69@$18.19
Northern Basic	19.90
Southern Ohio No. 2	19.90
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	19.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	14.00@14.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.26@21.76
Virginia No. 2	24.04
Basic	19.75@20.25
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	20.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	20.26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.30	3.90†
No. 12	2.15@2.25	3.45	3.35	3.95†
No. 14	2.25@2.35	3.55	3.45	4.00†
No. 16	2.35@2.45	3.65	3.55	4.10†
Black				
Nos. 18 to 20	2.65	3.85	3.70	3.80
No. 22	2.80	4.00	3.85	3.95
No. 24	2.85	4.05	3.90	4.00
No. 26	2.95	4.15	4.00	4.10
No. 28	3.10	4.75	4.15	4.25
Galvanized				
No. 10	2.70@2.80	4.20	4.05	4.05
Nos. 12 to 14	2.80@2.90	4.30	4.15	4.15
No. 16	2.90@3.00	4.40	4.25	4.25
No. 18	3.05@3.15	4.55	4.40	4.40
No. 20	3.20@3.30	4.70	4.60	4.55
No. 22	3.25@3.45	4.75	4.65	4.60
No. 24	3.50@3.60	4.90	4.75	4.75
No. 26	3.65@3.75	5.15	5.00	5.00
No. 28	3.90@4.00	5.40	5.25	5.25

*Light plates. †Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness B.w.g. and Decimal Fractions		Outside Diameter in Inches ½	⅝	¾	⅞	1	1¼	1½
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.60	3.65	3.60
Cold drawn, flat or square‡	4.10	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.30†	3.00	3.00
Soft steel bar shapes	3.30†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.25	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{2}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots.

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			49.00
Lead, pigs, E. St. Louis	6.60	New York	8.00
Zinc, slabs, E. St. Louis	6.80	New York	8.25

	New York	Cleveland	Chicago
Antimony, slabs	11.25	12.25	14.50
Copper sheets, base	27.75	27.75	27.75
Copper wire, mill, base	20.12½	20.12½	20.12½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	24@25	24.30	24.30
Zinc sheets (casks).....	10.50@11.00	11.70	10.11
Solder (½ and ½).....	33.25	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			65.00
Commercial genuine, intermediate grade.....			48.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold drawn.....	53.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	15.50 @15.62½	13.50	13.00 @14.00
Copper, heavy, and wire..	14 25 @15.50	13.00	12.00 @13.00
Copper, light, and bottoms	13.00 @13.50	12.50	11.00 @12.00
Heavy lead.....	5.37½@ 5.62½	6.25	4.75 @ 5.25
Tea lead.....	3.75 @ 4.00	4.25	3.75 @ 4.25
Brass, heavy, yellow.....	8.25 @ 8.75	8.00	8.00 @ 8.50
Brass, heavy, red.....	12.00 @12.50	12.50	11.75 @12.25
Brass, light.....	7.00 @ 7.50	7.50	7.00 @ 7.50
No. 1 yellow rod turnings.	9.50 @10.00	9.00	9.00 @ 9.50
Zinc.....	3.25 @ 3.75	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16	38.00 per M	.16
Sal-soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.172	.11	.14
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.75	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.24
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.033	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.036	.036	.034
Brass rods.....	per lb..	.2125	.2125	.17
Solder (½ and ½).....	per lb..	.3325	.3375	.3225
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.05
Lard cutting oil.....	per gal.	.75	.75	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.86	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.08	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.65@2.75
Coke, prompt foundry, per net ton...	Connellsville,		3.75@4.85
White lead, dry or in oil...	100 lb. kegs....	New York,	13.75
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7/16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Office of Panama Canal—will receive bids until Sept. 20 for woodworking machinery, steel tubing, etc., also until Sept. 26, for welding machine, copper covered tubing, etc.

Mich., Detroit — Jeschke Tool Co., 14220 Mack Ave.—milling machine.

Mich., Detroit—Master Tool & Die Co., 3155 East Willis Ave.—milling machine.

Mich., Detroit — Timken Detroit Axle Co., Clark Ave.—general equipment for finishing axles and parts for proposed 3 story, 80 x 120 ft. plant.

Mich., Kalamazoo—Checker Cab Co.—equipment for dry kilns for wood body material for proposed 1 and 2 story cab factory on South Pitcher St.

Minn., Minneapolis — City, c/o F. S. Gram, Purch. Agt.—large lathe for street department.

Mo., St. Louis—Clardel Garage, 5635 Delmar Blvd.—automobile repair shop equipment, etc.

Mo., St. Louis—Mound City Electrical Engineering Co., 222 South 8th St.—10 ton gasoline driven caterpillar crane with 40 ft. boom complete.

Wis., Waukesha—Spring City Foundry Co.—machinery and equipment for the manufacture of automobile products for proposed factory.

Ont., Brantford—Strachen Mfg. Co., Second Bldg.—equipment for the manufacture of iron furniture and electric refrigerators, for recently acquired factory. Estimated cost $25,000.

Ont., Hamilton—International Harvester Co. of Canada, Sherman Ave.—machinery and equipment for proposed addition to forge shop. Estimated cost $40,000.

Ont., Hamilton—Steel Co. of Canada—prices on equipment for proposed new fence mill. Estimated cost $100,000.

Ont., Leamington — Castle Shell Cast Fireplaces, Ltd., E. J. Castle, Mgr.—equipment for the manufacture of concrete, stone, brick and composition fireplaces. $25,000.

Ont., St. Catharines—General Motors Co. of Canada, Oshawa—metal working equipment for the manufacture of automobile parts and specialties for proposed 1 story, 120 x 480 ft. addition to factory here. Estimated cost $175,000.

Ont., Tecumseh—Canadian National Railways and Wabash Rys. Co., c/o H. W. Matthews, St. Thomas, Supt.—prices on complete equipment for proposed round house, machine shops, yards, etc. here. Estimated cost $2,000,000.

Opportunities for Future Business

Ala., Birmingham—Lake Erie Bolt & Nut Co., 915 East 63rd St., Cleveland, O., acquired plant of American Bolt Co. here and plans extensions and improvements.

Ala., Birmingham—Lamson & Sessions Bolt Co., 1972 West 85th St., Cleveland, O., has work under way on the construction of a plant for the manufacture of bolts, nuts and rivets here. Estimated cost $500,000.

Ala., Gadsden—Gulf States Steel Co., B-M Bldg., Birmingham, will soon award contract for the construction of a sheet mill here. Estimated cost $2,000,000.

Ark., Little Rock—City is having plans prepared for the construction of an airport including hangars, shops, etc. Estimated cost $200,000. Love-Sultan Inc., 6625 Delmar Blvd., St. Louis, Mo., Archt.

Calif., Oakland—Retail Center Garage Assn., awarded contract for a 3 story garage at 11th and Washington Sts. Estimated cost $150,000.

Conn., Hartford — Skayef Ball Bearing Co., 330 Park Ave., awarded contract for addition and alterations to factory at New Park Ave. Estimated cost to exceed $40,000. Noted May 16.

Calif., Santa Cruz—Airport Engineering Co., Russ Bldg., San Francisco, had plans prepared for the construction of an airport including machine shop, etc. here.

Ga., Atlanta—Mueller Co., Decatur, Ill. manufacturers of plumbing and heating supplies, has work under way on the construction of a branch factory to include foundry, machine shop, etc. here. Estimated cost $100,000.

Ill., Chicago—Burton Auto Spring Co., 2433 West 48th St., awarded contract for a 1 story addition to factory.

Ill., Chicago—Faith Mfg. Co., 2531 North Ashland Ave., is receiving bids for a 2 story, 120 x 200 ft. factory for the manufacturing of die castings at Thorndale and Crawford Aves. Estimated cost $40,000.

Ill., Chicago—Modern Handy Button Machine Co., M. Perlman, Pres., 2407 West Ohio St., awarded contract for a 1 story addition to factory.

Ill., Rockford — Rockford Drop Forge Co., 2031 South 9th St., awarded contract for the construction of a 1 story, 85 x 274 ft. factory on 9th St. Estimated cost $150,000.

Mass., Cambridge (Boston P. O.) — F. S. Payne Co., 75 Radcliff Ave., is receiving bids for a 2 story, 50 x 110 ft. addition to machine shop on Richdale St. Codman & Despradelle, 27 Kilby St., Boston, Archts.

Mass., Leominster—D. D. Wass, c/o J. Bilzerian, 339 Main St., is having plans prepared for a 1 story, 50 x 120 ft. repair shop and service station at 29-59 Water St.

Mass., Lynn—M. Young, 60 Western Ave., is receiving bids for a 1 story repair and service garage. Estimated cost $40,000. G. A. Cornet, 7 Munroe St., Archt.

Mass., West Springfield (br. Springfield) — Boston & Albany R.R. Co., South Station, Boston, is receiving bids for additions to shops here. Estimated cost $500,000. G. A. Kirby, Boston, Ch. Engr. Noted July 25.

Mass., Worcester—C. B. Jenne, 97 Temple St., awarded contract for a 1 story, 100 x 145 ft., repair and service garage. Estimated cost $40,000.

Mich., Grand Rapids—Buick Motor Car Co., G. C. Thompson, 25 La Grave Ave., awarded contract for a 4 story, 119 x 120 ft. sales and service building on Sheldon Rd. Estimated cost $150,000. Noted Sept. 5.

N. H., Manchester—H. E. Hartman Inc., 11 Prospect St., is having revised plans prepared for the construction of a garage at Elm and WestBrook Sts. Estimated cost $50,000. A. W. Osberg, 508 Manchester St., Archt. Noted Mar. 14.

N. J., Florence—Florence Pipe Foundry & Machine Co., will soon award contract for a 1 story, 49 x 294 ft. foundry. Private plans.

N. J., Newark—J. C. Kohaut Inc., 117 Green St., will not construct 2 story woodworking plant at 173-177 New Jersey Railroad Ave. $40,000. Project abandoned.

N. J., West New York — Alfred Hofmann, awarded contract for the construction of a 100 x 125 ft. machine shop.

N. Y., Brooklyn—Forbush Realty Corp., 150 Broadway, New York, plans the construction of a garage at Broadway and West Johnson Ave. here. Estimated cost $40,000. E. M. Adelsohn, 26 Court St., Archt.

N. Y., Brooklyn—S. Getner and A. Golka, 310 A Hart St., plans a 100 x 150 ft. garage at India and West Sts. H. J. Murick, 44 Court St., Archt.

N. Y., Brooklyn — Josel Holding Corp., S. Friedman, Pres., 1440 5th St., plans the construction of a 2 story, 100 x 101 ft. garage at Senator St. and East Ridge Blvd. Estimated cost $50,000. Cohn Bros., 361 Stone Ave., Archts.

N. Y., Brooklyn—F. A. Lundquist, 1516 Emmons Ave., plans a 1 story, 93 x 166 ft. garage at East 15th St. and Emmons Ave. Estimated cost $45,000. E. M. Adelsohn, 26 Court St., Archt.

N. Y., Brooklyn—T. Murcott, 298 Union Ave., plans a 115 x 120 ft. shop at 15th St. and Wythe Ave. Estimated cost $40,000. Tillion & Tillion, 415 Lexington Ave., New York, Archts.

N. Y., Brooklyn—Newford Realty Co., 32 Court St., plans the construction of an 80 x 177 ft. garage at Gravesend Ave. and Village Rd. Estimated cost $75,000. G. J. Prowler, 367 Fulton St., Archt.

N. Y., Brooklyn—Romar Building Corp., 26 Court St., plans the construction of a 2 story, 50 x 100 ft. garage at Underhill Ave. and Bergen St. Estimated cost $50,000. E. M. Adelsohn, 26 Court St., Archt.

N. Y., Brooklyn—Trojan Holding Co., S. Hemmelstein, Pres., 32 Court St., plans a 2 story, 100 x 100 ft. garage, etc. at New York Ave. and Hawthorne St. Estimated cost $60,000. G. I. Prowler, 367 Fulton St., Archt.

N. Y., Buffalo—Stewart Motor Co., 93 Dewey Ave., will soon award contract for a 97 x 250 ft. factory. Estimated cost $60,000 North & Shelgren, Crosby Bldg., Archts.

N. Y., Mount Vernon—Westchester Housing Corp., 551 5th Ave., New York, will soon award contract for the construction of a 1 and 2 story garage, warehouse, etc., here. W. E. Lehman, 972 Broad St., Newark, N. J., Archt.

N. Y., New York—Excell Garage Co., C. Dages, Pres., 1227 Lexington Ave., plans a 4 to 6 story addition to garage at 163 East 84th St. Estimated cost $40,000. W. Shary, 22 East 17th St., Archt. Maturity about February. Noted Aug. 22.

O., Cleveland—Browne-Fuller Co., A. H. Preston, Purch. Agt., 1912 Scranton Rd., awarded contract for a 5 story, 77 x 215 ft. factory. Estimated cost $250,000.

O., Cleveland—Cleveland Union Terminal Co., c/o C. L. Bradley, Pres., Terminal Tower, had plans prepared for the construction of yard facilities buildings including machine shop, wheel lathe house, blacksmith shop, coach yard house, signal maintenance building, etc. Estimated cost $250,000. A. L. Falvey, Terminal Tower, Archt.

O., Cleveland—Pennsylvania R.R., Broad St. Station, Philadelphia, Pa., awarded contract for a 1 story, 35 x 70 ft. addition to machine shop. Estimated cost $40,000. T. J. Skillman, Philadelphia, Ch. engr. Noted Aug. 29.

O., Warren—Republic Iron & Steel Co., E. T. McCleary, Pres., South Market St., Youngstown, O., plans the construction of a new mechanical conduit and tubing department here. Estimated cost $1,000,000. Private plans.

Pa., Dravosburg—Airways & Aircraft Co. of America, Farmers Bank Bldg., awarded contract for improvements to airport including hangars, repair shops, etc. at Bettis Field here. Noted Sept. 5.

Pa., Erie—General Electric Co., River Rd., Schenectady, N. Y., is receiving bids for the construction of a 1 story alloy foundry on East Lake Rd. here. C. E. Schnur, Engr.

Pa., Pittsburgh — Westinghouse Electric & Mfg. Co., East Pittsburgh, is receiving bids for the construction of a 3 story, 50 x 155 ft. research building at Ardmore Blvd. here. B. H. Prack, Martin Bldg. N. S., Pittsburgh, Archt.

Tex., Beaumont — Beaumont Iron Works, 1450 Crockett St., plans extensions and improvements to plant. Estimated cost $60,000. Private plans.

Tex., Dowling — Kansas City Southern Ry. Co., Kansas City, Mo., plans the construction of a central terminal, to include machine and locomotive shops, etc., here. Estimated cost $1,000,000. A. N. Reece, Ch. Engr.

Tex., Menard — City is having preliminary plans prepared for the construction of an airport to include hangar, machine shop, etc. Estimated cost $60,000.

Vt., St. Johnsbury—Dwight Motor Corp., is having plans prepared for a 2 story, 110 x 135 ft. service building. Estimated cost $50,000. A. W. Osberg, 508 Manchester St., Manchester, N. H., Archt.

Ont., Walkerville—Dominion Specialties Co., 240 Walker Rd., L. Newnham, Pres., plans the construction of a 1 story, 100 x 200 ft. factory for the manufacture of automobile specialties. Estimated cost $60,000. Private plans.

Ont., Ottawa—Ford Motor Co. of Canada, 125 Laurier St. E., Montreal, Que., D. R. Campbell, 130 Albert St., Ottawa, Rep., plans the construction of a garage here. Estimated cost $150,000.